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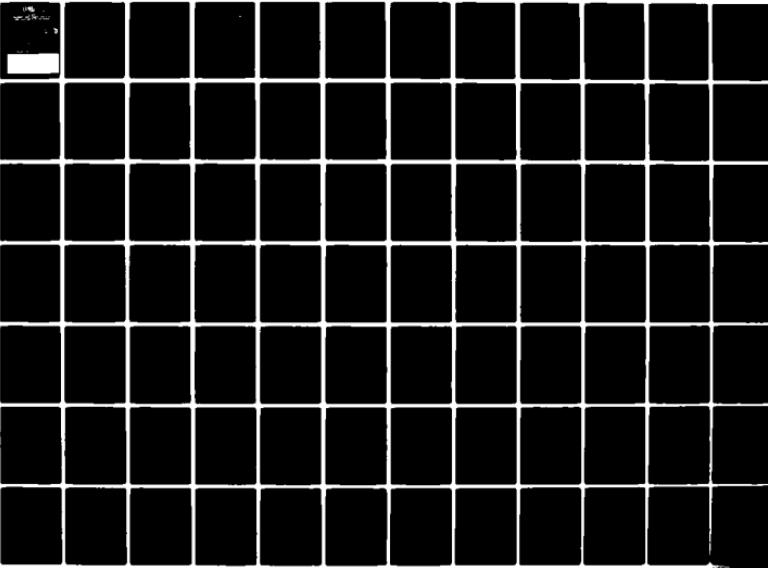
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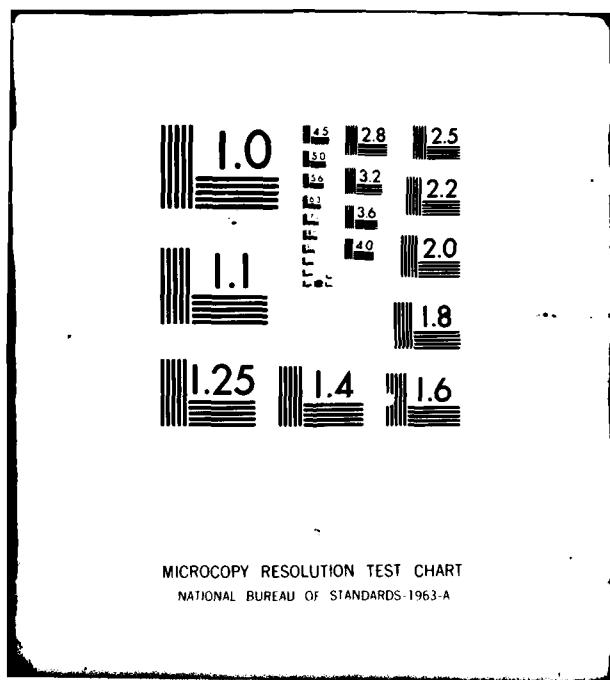
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FINAL REPORT

PROCUREMENT CONCEPT FEASIBILITY STUDY OF THE
COMBAT SYSTEM ARCHITECTURE (CSA) PROGRAM

March 1980



Prepared for

Navy Command and Control Systems,
Lead Lab
Naval Research Laboratory
Washington, D.C.

under Contract N00173-79-C-0463

by

J. Fedor
D. Kober

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2551 Riva Road
Annapolis, Maryland 21401

Publication 1666-01-1-2154

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) PROCUREMENT CONCEPT FEASIBILITY STUDY OF THE COMBAT SYSTEM ARCHITECTURE (CSA) PROGRAM.		5. TYPE OF REPORT OR PERIOD COVERED Final Report. 10 Sept. 79-25 Jan. 80
6. AUTHOR(s) J. S. Fedor D. Kober	7. CONTRACT OR GRANT NUMBER(s) 15. N00173-79-C-0463	14. CONTRACT OR GRANT NUMBER(s) 1666-01-1-2154
8. PERFORMING ORGANIZATION NAME AND ADDRESS ARINC Research Corporation 2551 Riva Road Annapolis, Maryland 21401	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS Program Element: 63568N Project No. 15. S1231 Work Unit No.: 0192-1	
11. CONTROLLING OFFICE NAME AND ADDRESS Navy Command and Control Systems, Lead Labs Naval Research Laboratory Washington, D. C.	12. REPORT DATE 25 JUN 80	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 11 Mar 80	13. NUMBER OF PAGES 12 13.2	
16. SECURITY CLASS. (if different from Report) UNCLASSIFIED		
18a. DECLASSIFICATION/DOWNGRADING SCHEDULE		
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release; Distribution Unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) Approved for Public Release, Distribution Unlimited.		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Commercial Airlines Acquisition Methodology, Air Force Avionics Acquisition Methodology, Department of the Navy (DN) Acquisition Methodology Form, Fit and Function (F ³), ARINC Characteristic, Warranty Combat System Architecture (CSA), Competition, Open-Forum		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The Navy has embarked upon a program to determine the feasibility of using Combat System Architecture (CSA) concepts in the design of combat system elements of future Naval combatant ships. The objective of the study described herein was to determine the feasibility of applying concepts from the Commercial Airline Acquisition Methodology (CAAM) into the Navy's CSA program. CAAM profiles, Air Force application of CAAM, and the Navy acquisition methodology were identified. A comparative analysis of the methodologies was performed. Conclusions and recommendations were formulated concerning those		

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**features of CAAM which are potentially feasible for implementation into
the CSA program.**

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ABSTRACT

The Navy has embarked upon a program to determine the feasibility of using Combat System Architecture (CSA) concepts in the design of combat system elements of future Naval combatant ships. The objective of the study described herein was to determine the feasibility of applying concepts from the Commercial Airline Acquisition Methodology (CAAM) into the Navy's CSA program. CAAM profiles, Air Force application of CAAM, and the Navy acquisition methodology were identified. A comparative analysis of the methodologies was performed. Conclusions and recommendations were formulated concerning those features of CAAM which are potentially feasible for implementation into the CSA program.

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SUMMARY

This report presents the results of a study performed by ARINC Research Corporation under Contract N00173-79-C-0463 for the Navy Command and Control Systems, Naval Research Laboratory, Washington, D.C. The purpose of the study was to investigate the feasibility of implementing some of the concepts of the Commercial Airlines Acquisition Methodology (CAAM) into the Navy's Combat System Architecture (CSA) Program. The CAAM was selected for analysis because it currently implements several cost-effective techniques for the acquisition of complex equipment. These concepts have proven successful in the airline industry and ARINC Research has recently assisted the U.S. Air Force in applying the concept to the planning and acquisition of aircraft avionic equipment.

The approach taken for this study was to investigate and document the processes that constitute the following three acquisition methodologies:

- Commercial Airlines Acquisition Methodology
- U.S. Air Force Avionics Acquisition Methodology
- U.S. Navy Acquisition Methodology

Graphic presentations were used to illustrate the hierarchical relationships of each methodology.

A comparative analysis of the three methodologies was conducted to determine areas of compatibility between the Navy's acquisition methodology and those of the CAAM and the Air Force avionics acquisition methodology. The objective of the analysis was to determine if the CAAM or Air Force acquisition methodologies contained features that could be beneficial to the Navy. The last phase of the study was an assessment of the feasibility of implementing the airline industry procurement concepts in the Navy CSA program, considering the need for a strong technology and development planning process.

The major conclusions resulting from the analysis are summarized as follows:

- Specific CAAM techniques are feasible for implementation in the Navy CSA program. There are several CAAM techniques that have been adapted by the Air Force for acquisition of avionics and that indicate potential for development of an implementation plan for Navy CSA program acquisitions.

- Once requirements have been determined, the CAAM and Air Force acquisition methodology encourage industry participation to determine the best means of accomplishment. In the airlines, this process involves "open forum" meetings of concerned and interested representatives to establish a set of acceptable specifications. In the Air Force, an avionics planning conference is held annually to accomplish an exchange of information among members of the military avionics communities.
- The CAAM uses form, fit, and function (F³) specifications to state the essential requisites of new equipment. These specifications stress maximum possible standardization of equipment characteristics without seriously hampering industry's engineering initiative. The Air Force and Navy Air Systems Command (NAVAIR) have undertaken initiatives to employ the F³ specification process on selected procurements.
- The Air Force and Navy use competition in their respective methodologies only to select a contractor at the outset of an acquisition. The CAAM exploits competition throughout the equipment or system life cycle in such areas as multiple procurement sources, equipment warranty, equipment maintenance, and equipment logistic support.

The following recommendations are made on the basis of the analysis:

- The Navy CSA program should consider implementing CAAM techniques determined to be feasible and adapt these techniques to the acquisition of designated CSA program systems and equipments.
- The CSA program should develop the requisite planning to coordinate implementation of CAAM elements into current and future acquisition strategies.
- The Navy should invite industry representatives to participate in the open forum process for the establishment and review of appropriate specifications necessary to achieve CSA program requirements for systems and equipments.
- Certain systems and equipments identified by the CSA program should be technically described and procured through the use of F³ type specifications.
- The CSA program should utilize innovative contract negotiation strategies that emphasize competition throughout the life cycle of the system and equipment.

CONTENTS

	<u>Page</u>
ABSTRACT	iii
SUMMARY	v
CHAPTER ONE: INTRODUCTION	1-1
1.1 Background	1-1
1.2 Objective	1-2
1.3 Study of Objective	1-2
1.4 Report Organization	1-3
CHAPTER TWO: COMMERCIAL AIRLINES ACQUISITION METHODOLOGY	2-1
CHAPTER THREE: U.S. AIR FORCE AVIONICS ACQUISITION METHODOLOGY	3-1
CHAPTER FOUR: NAVY SYSTEMS ACQUISITION METHODOLOGY	4-1
CHAPTER FIVE: QUALITATIVE COMPARISONS OF NAVY AND COMMERCIAL ACQUISITION METHODOLOGIES	5-1
5.1 Acquisition Program Phases	5-1
5.1.1 CAAM	5-1
5.1.2 U.S. Air Force Avionics Acquisition Methodology	5-2
5.1.3 Navy Acquisition Methodology	5-2
5.1.4 Similarities and Differences	5-2
5.2 Scope of Acquisition Program	5-2
5.2.1 CAAM	5-2
5.2.2 U.S. Air Force Avionics Acquisition Methodology	5-2
5.2.3 Navy Acquisition Methodology	5-3
5.2.4 Similarities and Differences	5-3
5.3 Competition	5-3
5.3.1 CAAM	5-3
5.3.2 Navy Acquisition Methodology	5-3
5.3.3 Similarities and Differences	5-3

CONTENTS (continued)

	<u>Page</u>
5.4 Research, Development, Test, and Evaluation (RDT&E) . . .	5-4
5.4.1 CAAM	5-4
5.4.2 U.S. Air Force Avionics Acquisition Methodology	5-4
5.4.3 Navy Acquisition Methodology	5-4
5.4.4 Similarities and Differences	5-5
5.5 Source-Selection Criteria	5-5
5.5.1 CAAM	5-5
5.5.2 Navy Acquisition Methodology	5-6
5.5.3 Similarities and Differences	5-6
5.6 Procurement Cost	5-6
5.6.1 CAAM	5-6
5.6.2 Navy Acquisition Methodology	5-6
5.6.3 Similarities and Differences	5-7
5.7 Procurement Package	5-7
5.7.1 CAAM	5-7
5.7.2 Navy Acquisition Methodology	5-7
5.7.3 Similarities and Differences	5-7
5.8 Equipment Development	5-8
5.8.1 CAAM	5-8
5.8.2 U.S. Air Force Avionics Acquisition Methodology	5-8
5.8.3 Navy Acquisition Methodology	5-8
5.8.4 Similarities and Differences	5-8
5.9 Logistics Support/Warranty	5-8
5.9.1 CAAM	5-8
5.9.2 Navy Acquisition Methodology	5-9
5.9.3 Similarities and Differences	5-9

CONTENTS (continued)

	<u>Page</u>
5.10 Configuration Management and Standardization	5-9
5.10.1 CAAM	5-9
5.10.2 U.S. Air Force Avionics Acquisition Methodology	5-10
5.10.3 Navy Acquisition Methodology	5-10
5.10.4 Similarities and Differences	5-10
5.11 Summary	5-11
CHAPTER SIX: FEASIBILITY ANALYSIS	6-1
6.1 Acquisition Program Phases	6-1
6.2 Competition	6-1
6.3 Procurement Package	6-2
6.4 Equipment Development	6-2
6.5 Warranty Provisions	6-3
6.6 Configuration Management	6-3
6.7 Summary	6-3
CHAPTER SEVEN: CONCLUSIONS AND RECOMMENDATIONS	7-1
7.1 Conclusions	7-1
7.2 Recommendations	7-2
APPENDIX A: INTERPRETATION OF DIAGRAMS	A-1
APPENDIX B: BRIEFING PACKAGE FOR THE PROCUREMENT CONCEPT FEASIBILITY STUDY OF THE COMBAT SYSTEM ARCHITECTURE (CSA) PROGRAM	B-1
APPENDIX C: GLOSSARY OF ACRONYMS AND ABBREVIATIONS	C-1

LIST OF DIAGRAMS

	<u>Page</u>
CHAPTER TWO: COMMERCIAL AIRLINES ACQUISITION METHODOLOGY	2-1
C-0 Acquire Commercial Airlines Avionics	2-5
C-0A Acquire Commercial Airlines Avionics	2-7
C-1 Determine Requirements	2-9
C-1I1 Airlines Electronic Engineering Committee	2-11
C-2 Develop Specification (ARINC Characteristic)	2-13
C-2I1 ARINC Characteristic	2-15
C-3 Select Vendor	2-17
C-4 Procure Equipment	2-21
CHAPTER THREE: U.S. AIR FORCE AVIONICS ACQUISITION METHODOLOGY	3-1
A-0 Acquire U.S. Air Force Avionics	3-7
A-0A Acquire U.S. Air Force Avionics	3-9
A-1 Determine Requirements	3-13
A-2 Conduct Advanced Development	3-15
A-3 Develop F Specification	3-19
A-4 Conduct Engineering Qualification	3-21
A-5 Select Production Source(s)	3-23
A-6 Test and Install Equipment	3-27
CHAPTER FOUR: NAVY SYSTEMS ACQUISITION METHODOLOGY	4-1
N-0 Acquire Navy Systems	4-5
N-0A Acquire Navy Systems	4-7
N-1 Perform Conceptual Studies	4-9
N-1I1 Mission Element Need Statement	4-11
N-1I2 Navy Systems Acquisition Levels	4-13
N-1I3 Determine Program Milestone Review Responsibility- DSARC Milestone 0	4-15
N-1I4 Decision Coordinating Paper (DCP)/Navy Decision Coordinating Paper Content	4-17
N-2 Explore Alternative Systems Concepts	4-19
N-3 Validate and Demonstrate Systems Concepts	4-21
N-3I1 Prepare and Conduct Milestone I, II, and III Reviews	4-25
N-4 Develop Engineering Development Models	4-31
N-5 Develop Production Models	4-35

CHAPTER ONE

INTRODUCTION

Increasing emphasis has been placed on reducing the costs and improving the effectiveness of military electronic equipment. Constraints on military budgets, coupled with inflation and mounting operation and support costs, are prompting a search for positive methods of cost reduction in equipment acquisition and throughout the life cycle of an equipment. The traditional effort has been a reliability-improvement program involving parts screening, predictions, more stringent specifications, and rigorous demonstration and acceptance testing. While some improvements have been made, the overall results of such programs have been disappointing.

Alternative techniques for the acquisition, maintenance, and support of equipment are available. One such technique is the application of commercial practices and equipment. The Department of Defense (DoD) has recently directed attention to the procurement technique of U.S. commercial airlines. This technique, known as the Commercial Airline Acquisition Methodology (CAAM), describes an approach in technology and development planning for the procurement of aircraft avionics. Techniques of this type are of interest because of their apparent simplicity in contrast to military processes and their apparent efficiency in acquiring state-of-the-art electronic systems that offer excellent cost and reliability advantages.

1.1 BACKGROUND

The Chief of Naval Operations (CNO) tasked Commander, Naval Sea Systems Command (COMNAVSEA) to investigate a newly proposed approach to the design of the combat system of future combatants. In the summer of 1978, COMNAVSEA convened a board composed of technical representatives from activities involved with Navy combat system design to conduct an "in-house" study. The study had two primary objectives; first, review the OPNAV proposed Combat System Architecture to determine its feasibility for incorporation in future combatants and second, develop a management plan that could assure follow-through within the CNO/CNM management structure. The study concluded that 1) it was feasible to use combat system architecture in future combat system design and 2) the success of the CSA program would be dependent upon the development of a management organization that could effectively cross the many existing organizational boundaries needed to interact on the CSA program.

The CSA program office was established within NAVSEA to further explore the issues and recommendations raised by the findings of the NAVSEA "in-house" study.

The Combat System Architecture (CSA) discipline being developed by the Navy provides an approach which is potentially capable of resolving many recurring combat system management and technical problems. CSA advocates a standard system architecture for surface combatants as a step toward achieving standardization among ship classes. CSA can also provide management visibility to review the surface combatant requirements and combat-system-related research and development (R&D) which can facilitate in identifying redundant programs and in resolving conflicting programs and can also permit the preparation of credible combat-system-related budget requests, which can be justified and defended. The CSA program additionally must take care to avoid the introduction or use of acquisition techniques that could hamper the necessary technology and development planning process required for successful implementation of the CSA program.

ARINC Research Corporation has long been involved with various efforts to develop improved DoD acquisition methodologies. Our out-growth from Aeronautical Radio, Inc. (ARINC) has closely aligned the company with the commercial airlines experiences in avionics acquisition. Because of this familiarity and experience, ARINC Research recently assisted the U.S. Air Force in applying some of the concepts that the commercial airlines successfully employ in avionics acquisition. The combination of our past experience and knowledge, together with the current support of the U.S. Air Force avionics planning and acquisition, led to the investigation of implementing portions of the CAAM into the Navy's CSA program acquisition methodology.

1.2 OBJECTIVE

The objective of this contractual effort was to determine the feasibility of implementing commercial airlines avionics acquisition concepts in the Navy's combat system architecture program.

1.3 STUDY APPROACH

The basic approach to achieving the objective of this study involved the following five principal tasks:

- . Task 1: Summarize the commercial airlines acquisition methodology
- . Task 2: Review the U.S. Air Force application of the commercial airlines concepts
- . Task 3: Identify the Navy combat system architecture acquisition methodology
- . Task 4: Compare the Navy CSA acquisition methodology with the CAAM and U.S. Air Force CAAM application
- . Task 5: Assess the feasibility of implementing airline acquisition concepts into the Navy CSA program

For task 1, the CAAM was examined and then documented by means of graphic presentations. The description summarized the basic functions of the methodology and concentrated on depicting the methodology in a series of graphic top-down-level diagrams.

Task 2 was accomplished in essentially the same manner as task 1. The U.S. Air Force application of commercial airlines acquisition concepts in their acquisition of avionics was researched and documented. Similarly, a graphical presentation was used.

Task 3 involved identifying the Navy CSA program acquisition methodology. Interviews were conducted and documents researched to arrive at the projected acquisition methodology. The methodology was then documented with the same graphical techniques as in Tasks 1 and 2.

For Task 4, a comparative analysis was performed to determine the similarities and differences between the Navy acquisition methodology and the Air Force and airlines methodologies.

Task 5 involved assessing the feasibility of implementing selected commercial airlines acquisition concepts in the Navy CSA program. Basis for selection of these concepts was predicated upon those that offered potential for improvement over current CSA practices. Recommendations were then prepared outlining the areas for consideration along with initial implementation steps.

1.4 REPORT ORGANIZATION

Chapter Two of this report describes the commercial airlines acquisition methodology. Chapter Three presents the U.S. Air Force avionics acquisition methodology. Chapter Four presents the Navy acquisition methodology. In Chapter Five, the methodologies are compared, with emphasis on the features of the CAAM that are potentially advantageous to the CSA program. This comparison encompasses general acquisition program features that emphasize the similarities and differences. Chapter Six discusses those concepts from the CAAM determined to have the greatest feasibility for implementation in the CSA program. Chapter Seven documents the conclusions and recommendations of the study. Appendix A describes the diagramming technique used in this report. Appendix B presents a briefing package prepared to summarize for the study program. Appendix C is a glossary of acronyms and abbreviations.

CHAPTER TWO

COMMERCIAL AIRLINES ACQUISITION METHODOLOGY

This chapter describes the commercial airlines acquisition methodology (CAAM). The airline procurement process represents the activities and responsibilities that are necessary to accomplish acquisition of standardized avionics. The CAAM methodology has evolved within the airline industry over the past 50 years and is commonly employed by most U.S. air carriers, many foreign carriers as well as segments of general aviation.

Throughout this discussion, the essence of the CAAM has been maintained. Key concepts such as the open-forum process, specification development, and contract negotiation strategies are discussed. Typically, the CAAM does not specify a specific sequence of events nor clearly identify phases of activity. A delineation of phases for the CAAM in this report has been made to describe the general sequence of events expected to occur. Care was taken to include those management activities that are clearly responsible for effecting this process.

Throughout this report, a specific technique was used in numbering the diagrams. (Appendix A presents a detailed description of the numbering system and graphic techniques used.) Basically, the first letter of each methodology is used to identify the diagrams, i.e., A = Air Force, C = Commercial, and N = Navy. Alphanumerics were then assigned in sequential order to identify each functional breakdown within a tier. CAAM activities are emphasized in diagrams C-0, C-1, C-2, C-3, and C-4. Various elements of the methodology are decomposed in informational diagrams. The informational diagrams are used to enhance the reader's understanding of key elements within the functional processes.

The following is a list of diagrams presented in the chapter:

- C-0 Acquire Commercial Airlines Avionics
- C-0A Acquire Commercial Airlines Avionics
- C-1 Determine Requirements
- C-1II Informational Diagram: Airlines Electronic Engineering Committee

- . C-2 Develop Specification (ARINC Characteristic)
- . C-2I1 Informational Diagram: ARINC Characteristic
- . C-3 Select Vendor
- . C-4 Procure Equipment

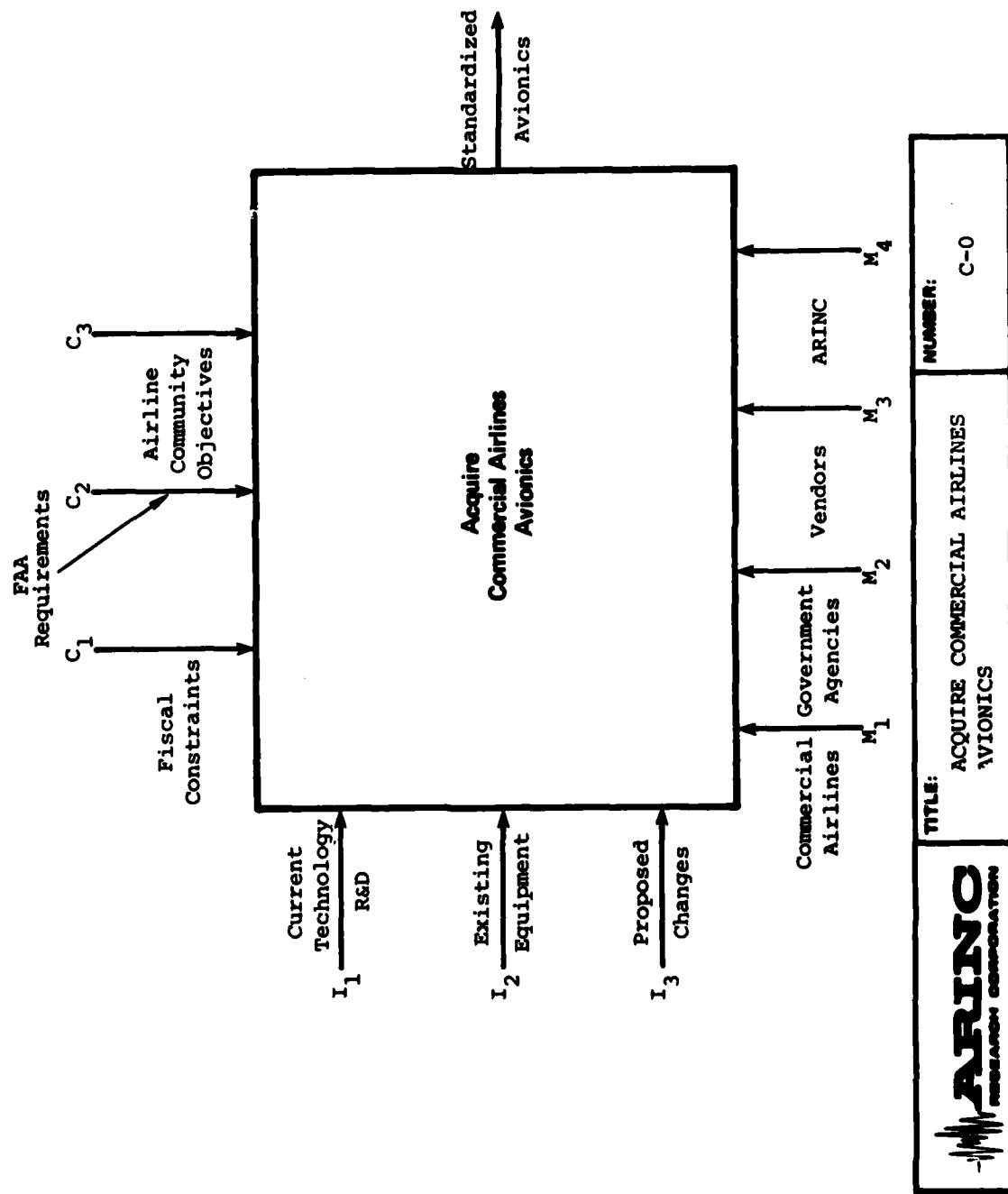
C-0 ACQUIRE COMMERCIAL AIRLINES AVIONICS

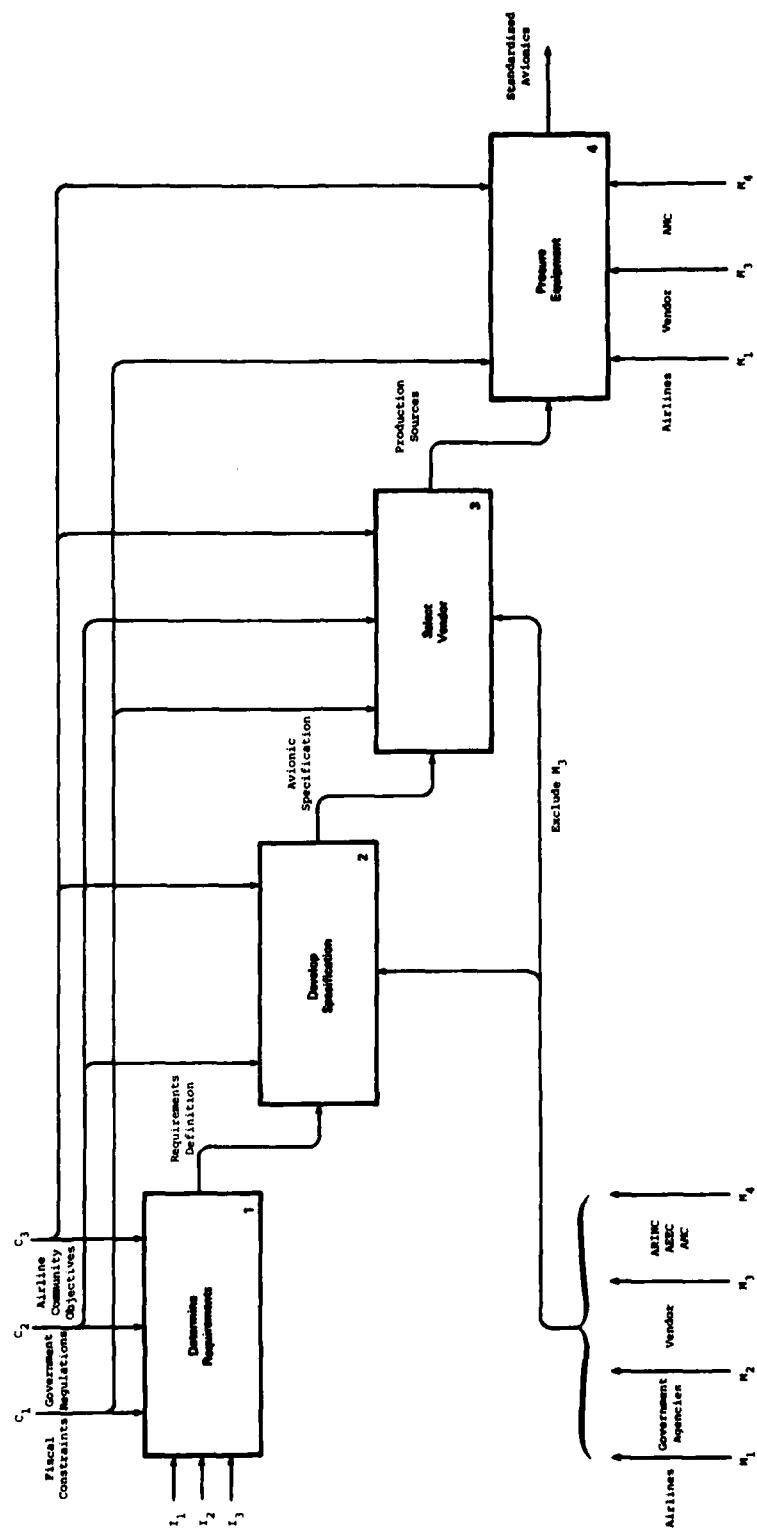
The commercial airlines acquisition methodology is structured to provide standardized avionics that are compatible throughout all participating airlines. This methodology is effected by the interactions of the airlines, the airframe/avionics industry, government agencies (primarily the Federal Aviation Agency (FAA)) and designated aviation organizations.

Collectively, the participants determine the type of avionics that should be investigated as candidates and made certifiable. Initially, they define the requirements and produce a description of the requirements. The preparation of the description is almost exclusively an airline function unless a specific requirement has been dictated by the FAA. The Airlines Electronic Engineering Committee (AEEC) is the focal activity in this process. The primary function of the AEEC is to formulate an ARINC Characteristic for the needed electronic equipment or system. Before Characteristics are published, they are coordinated and finalized through continued discussions among the AEEC participants. Although manufacturers and other interested parties participate in these discussions, it is important to note that only the AEEC Committee voting members have an official voice regarding the final Characteristic contents. The Characteristics do not precisely define the contents of the "black box" but describe the signals that enter and leave the box, together with the electrical, mechanical, and environmental interfaces.

The characteristics are published by the participating airlines to signal industry of their avionics requirements. In this way, industry is made aware of the airlines intentions to select an equipment vendor. This selection can occur as a result of collective negotiations, or each airline may act on its own. The airlines have long recognized the benefits of standardizing their avionics and therefore their negotiations with potential vendors are performed using the developed characteristic. Selection of a vendor is preceded by testing of sample avionics by the airlines. Upon completion of satisfactory testing and negotiations the airlines procure the equipment and the resulting product is a standard piece of avionic equipment.

In the following, four primary functions (determine requirements, develop specifications, select vendor, and procure equipment) are described and illustrated to highlight their key position in the CAAI process. It is necessary that the reader remember the viewpoint described in the diagrams is that of the purchasing organization (airlines). In addition, no attempt has been made to assign time periods to the entire process or any of its phases because each acquisition will vary depending on the equipment and technology being introduced.



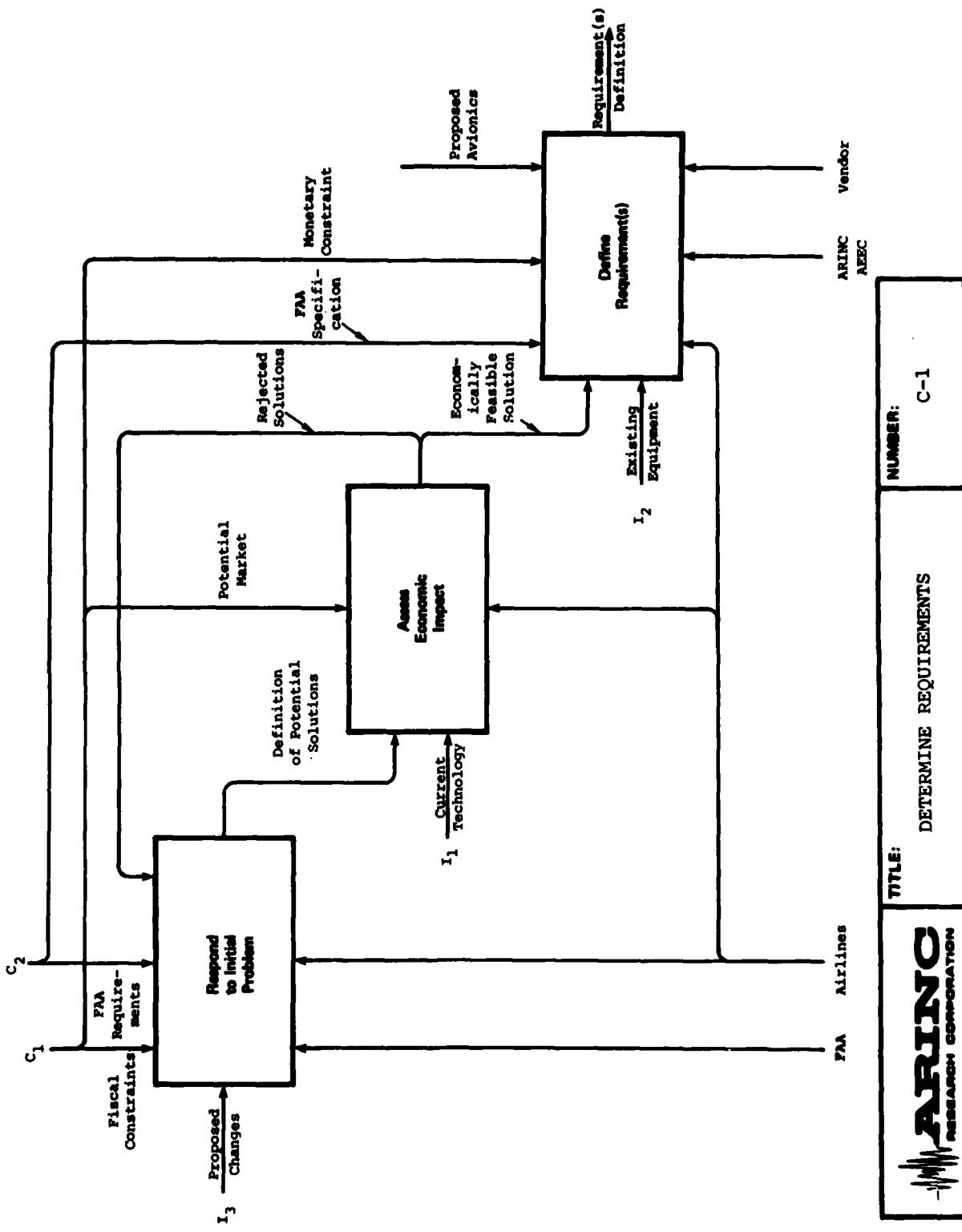


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C-1 REQUIREMENTS DETERMINATION

Airlines may recognize a requirement as the result of either an equipment need stated by a respective Airlines Electronic Engineering Committee (AEEC) member airline or an FAA order. The latter is less frequently the determining factor. The initial function of this phase has been termed problem response (see first box). In actuality there may not be a problem with existing avionics. A desire to enhance or replace existing avionics with new technology may receive enough collective support to be termed a requirement. Requirements are often generated as a result of the Avionics Maintenance Conference (AMC). The AMC is an open forum conference which meets annually to discuss an agenda of maintenance related problems. A considerable exchange of ideas transpires during this conference which often results in the generation of requirements.

The initial definition of requirements are assessed to determine if sufficient justification exists for their further development of the requirement. In most cases, the development follows if an operational necessity justifies the expenditure of funds for equipment acquisition. Although assessment of economic impact often determines requirement justification it is not the singular rationale. Once the requirement has been justified the requirement will be defined. If the airline or organization originating the requirement has not previously published the requirement, it will be defined and circulated.



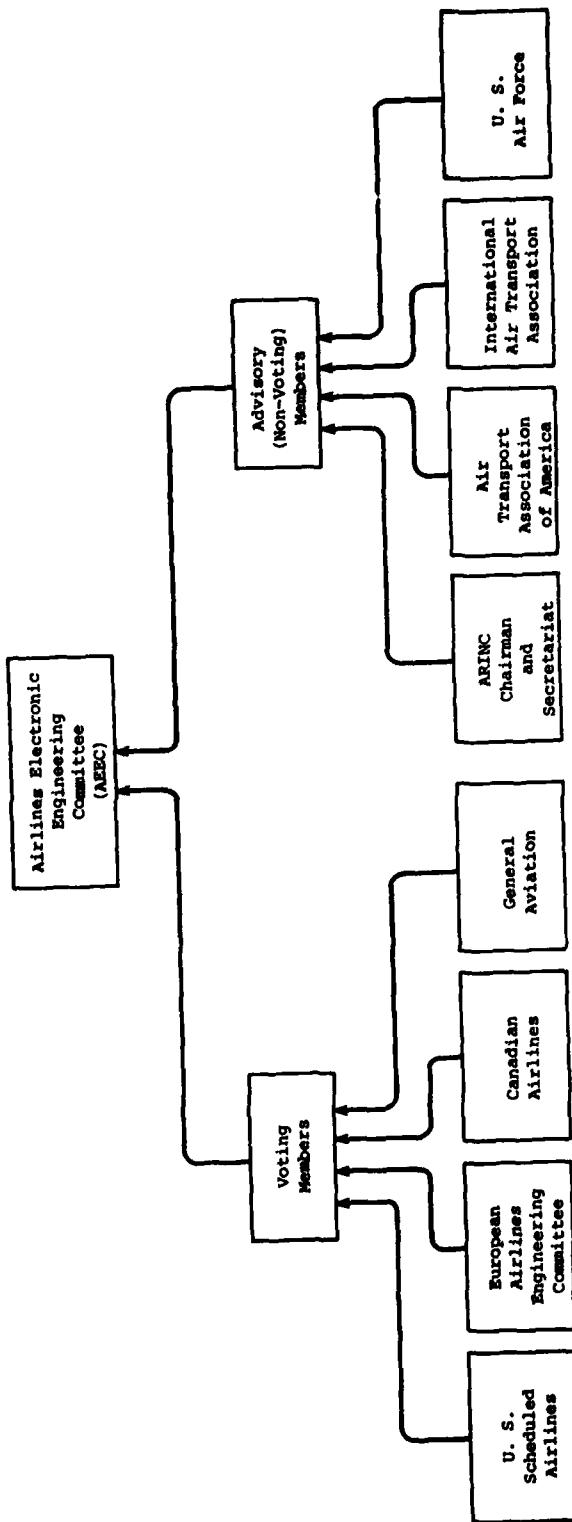
C-III AIRLINES ELECTRONIC ENGINEERING COMMITTEE (AEEC)

Because of the AEEC's success in preparing Characteristics (F specifications) for airline avionics, the committee has been frequently described as "a committee that works". The full committee consists of 31 persons, including the four staff members furnished by ARINC to function as Chairman and provide the secretariat functions. However, only 22 of the committee members are voting members, representing the U.S. scheduled airlines, European Airlines Engineering Committee, Canadian airlines, and general aviation. It is through this membership that the AEEC blends operations, maintenance, and engineering expertise. Many other interested parties, representing wide public interest, attend the meetings. Recent typical attendance has exceeded 300 contributing observers from airlines, governmental regulatory groups, military agencies, avionics and airframe manufacturers, and members of the press.

The primary function of the AEEC is to formulate ARINC Characteristics for electronic equipment and systems. An ARINC Characteristic is a form, fit, function type of specification and has a twofold purpose:

- To communicate to prospective manufacturers of airline electronic equipment the general desires of airline technical people, coordinated on an industry-wide basis, concerning a particular type equipment
- To promote maximum possible interchangeability (physical and electrical) without seriously hampering design initiative

The air transport industry, through the AEEC, does not choose to exercise any enforcing authority over the Characteristics. Consequently, after a Characteristic is issued, individual airlines can use it or not as they choose. It is not a "procurement" specification in the military sense. The AEEC has learned over the years that this very lack of authority necessitates Characteristics that are soundly based on technical and economic facts; the alternative is, in effect, no standard at all. By and large, this process has been quite successful because, through the use of Characteristics, the airlines have achieved significant improvements in reliability and cost while maintaining interchangeability among equipments developed by competitive suppliers.



Airlines Electronic Engineering Committee

ARINC RESEARCH CORPORATION	TITLE: AIRLINES ELECTRONIC ENGINEERING COMMITTEE	NUMBER: C-111
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C-2 DEVELOP SPECIFICATION (ARINC CHARACTERISTIC)

When sufficient justification for the development of a specification (ARINC Characteristic) has been established, the AEEC, by airline consensus, will establish a subcommittee to draft the document. To produce this document, a subcommittee chairman is named (usually from the airline with the greatest interest in the project). The subcommittee meetings attract interested airlines, manufacturers, and others to compile the first draft. The initial "strawman" draft may be the product of one of the avionics manufacturers, the AEEC secretariat, an airline, another source, or a combination of these.

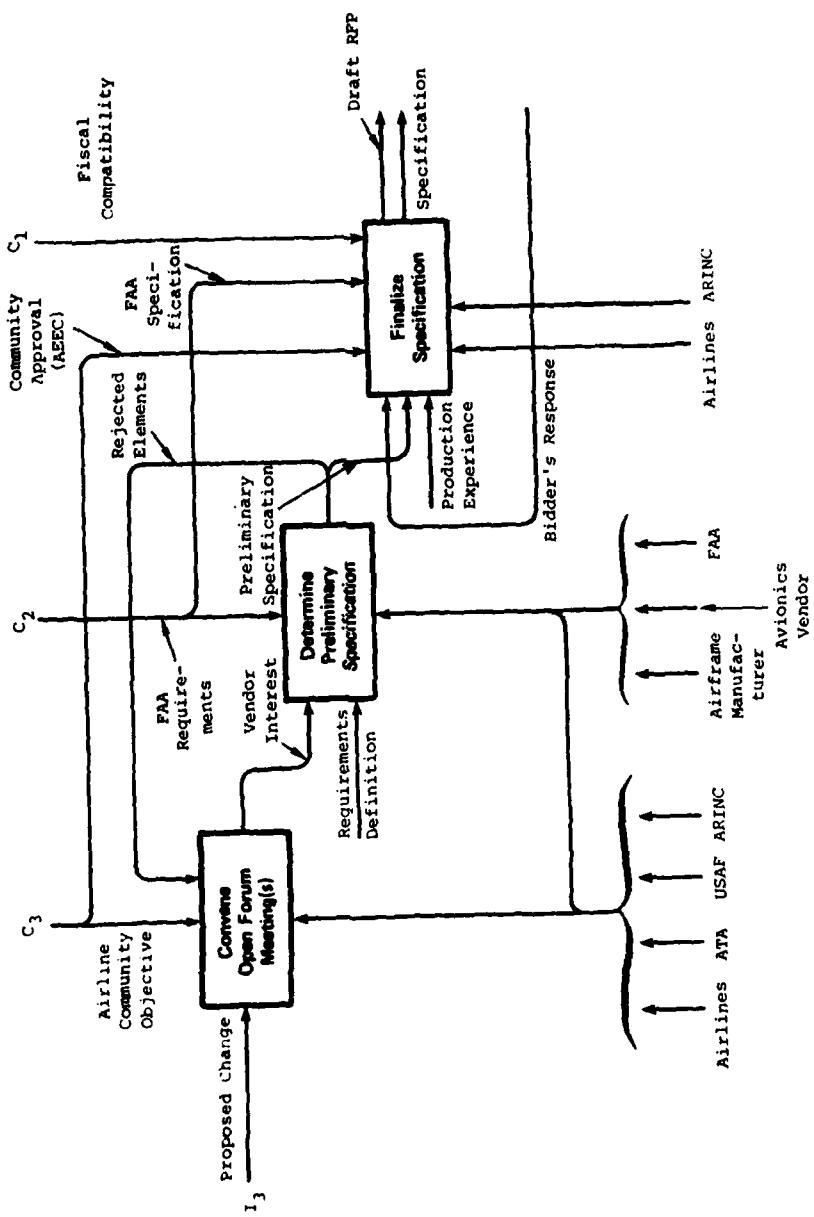
The subcommittee typically establishes agenda items that address various aspects of the Characteristic development. Subcommittee meetings are often held concurrently with other subcommittee meetings to facilitate an exchange of information and ensure system compatibility. The results of the meetings are carefully documented in AEEC letter reports.

Members of the subcommittee often exceed 100 individuals, representing the AEEC, airlines, ARINC staff, manufacturers, consultants, government [FAA, Federal Communications Commission (FCC), military], and others. The subcommittee frequently draws upon reports and independent studies of the Air Transport Association of America (ATA), Radio Technical Commission for Aeronautics (RTCA), and FAA in formulating a draft Characteristic.

A draft is circulated and reviewed by the full committee for critique and alternative recommendations. Comments are returned to the Secretariat and reviewed and consolidated into an updated draft, and then returned to the subcommittee. When the revision is completed, the draft is again distributed to all participants. After a suitable time for review, a meeting is scheduled to permit discussion of areas of controversy or conflict.

In case of disagreement or, more frequently where more than one approach is developed, the ARINC Characteristic contains a "commentary" statement reiterating the pros and cons of the subject, with whatever other guidance may be of value to the users of the document.

The approval cycle of the ARINC Characteristic consists of majority concurrence of the voting members of the AEEC and final approval by the ARINC Board of Directors. Thereafter, it is the task of the equipment manufacturers to convert the document into a competitive (in terms of cost and reliability) piece of equipment that can earn FAA certification and aviation-community acceptance. The usual timetable for producing a new Characteristic is about one year from the first AEEC meeting. If the requirements and the technology are not well defined, the process takes longer.



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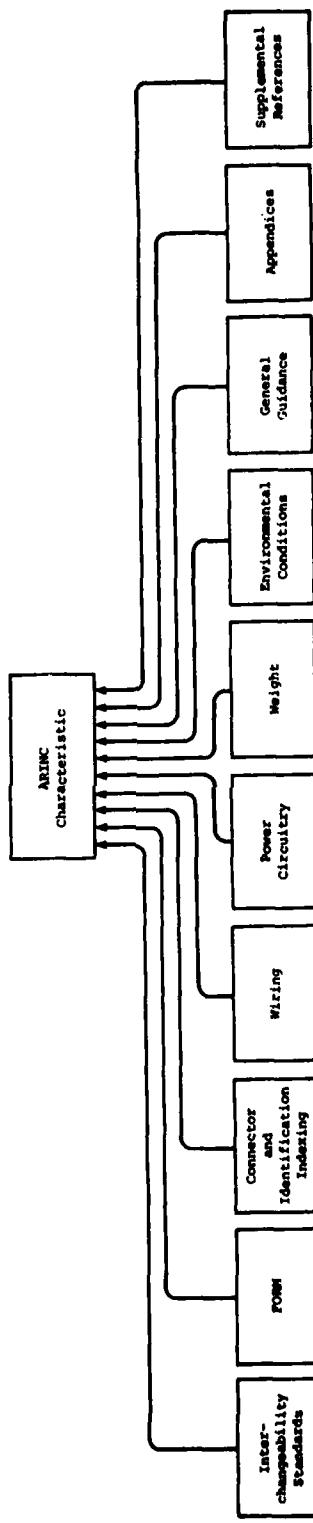
C-2II ARINC CHARACTERISTIC

A primary function of ARINC Characteristics (F³ specification) is to produce the standardization that will assure the interchangeability in an aircraft of equipment produced by various manufacturers. The airline industry considers equipment interchangeability to be the greatest advantage offered by the development of ARINC Characteristics, for only through such standardization can a "buyer's market" for the airlines be achieved.

An ARINC Characteristic thus has a twofold purpose:

- To indicate to prospective manufacturers of airline electronic equipment the opinion of the airline technical people, coordinated on an industry basis, concerning new equipment requirements.
- To channel new equipment designs in a direction that can produce maximum possible standardization of physical and electrical characteristics without seriously hampering engineering initiative.

The emphasis on the development of an ARINC Characteristic is technical accuracy and thoroughness, since the approval and use of the Characteristics are neither guaranteed nor required. The technical veracity of the specification must be unchallenged to gain consensus as the technical guidelines.



ARINC RESEARCH CORPORATION	TITLE: ARINC CHARACTERISTIC	NUMBER: C-211
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C-3 SOURCE SELECTION

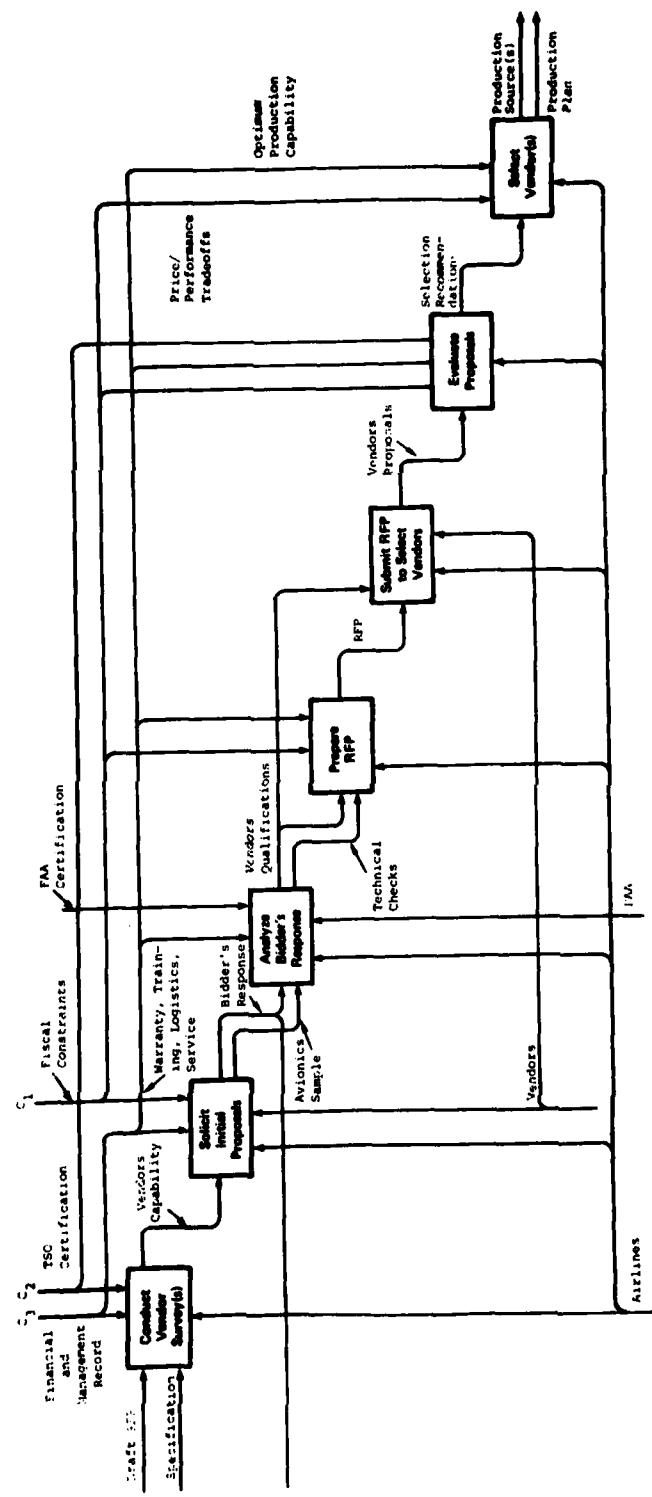
Prior to detailing this phase, it is important to note that source selection and avionics procurement is strictly a responsibility of the individual airlines. The initial source selection process is the conduct of vendor surveys. Several factors are considered in these surveys. The technical aspects of the intended purchase are not a consideration at this point; instead, the financial condition and management aspects of prospective vendors are paramount. Typically, the airline already has preferred vendors and it is necessary to address in detail only new manufacturers. Several factors are analyzed on the basis of public records, factory visits, discussions with the prospective vendor's management staff, or previous experience of other airlines.

On the basis of the results of the vendor surveys, initial proposals are solicited from selected vendors. Although the airline RFPs may be informal, they solicit key information on the various vendor's product performance and on their intentions concerning support in terms of warranty, training, and other logistics factors. In submitting their response to the airline, vendors usually include a sample of the product on consignment. This allows the airline to test the product in the same manner as the Government tests the bid sample. This initial request for proposals is similar to a request for qualifications since the samples are submitted; but it is termed RFP.

There are several factors that cause the concurrent avionics equipment development with the Characteristic development. Interested vendors will begin equipment development upon issuance of the preliminary specification. If the vendor wants to sell his equipment to the airlines or an airframe manufacturer, he must be ready to prove that he has an acceptable product conforming to the Characteristic that has been developed. Accordingly, he strives for a completed high-quality product, anticipating that it can be sold immediately.

In addition, a manufacturer desiring to have his equipment certified for use on civil aircraft must obtain such certification from the Federal Aviation Administration. Certification is issued on the basis of the manufacturer's conformance with FAA regulations and the applicable Technical Standard Order (TSO). TSOs contain the minimum performance and quality-control standards for articles (specified materials, parts, or appliances) used on aircraft. The performance standards in each TSO ensure that the article will operate satisfactorily or will fulfill its intended purpose under specified conditions.

An application for certification of equipment for civil aircraft use is granted or denied within 30 days of its receipt by the FAA. Once a



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TSO certification has been granted for a particular article, the manufacturer must produce the article in accordance with his application, conduct all required tests and inspections, and establish and maintain a quality-control system adequate to ensure that the article meets the requirements of the TSO.

The vendor's responses to the initial RFPS are analyzed to reduce the intended procurement to a few qualified vendors. This analysis centers on the technical and cost aspects of the products. The expected cost of each feature is carefully assessed, and requirements may be augmented or reduced on the basis of these costs. The airlines conduct in-house tests of consigned units, including bench and flight checks, although the latter are rarely conducted for established products because they are costly and involve a great deal of coordination with the appropriate authorities (e.g., FAA). If the product is new to the airline industry, extensive flight checks are made with the support and cooperation of other airlines, vendors, and regulatory agencies. During these checks, the requirements for test equipment and maintenance are critically examined.

As part of the evaluation, performance information is often sought from other users of the item being considered. Records and periodic publications of the Avionics Maintenance Conference (AMC) are also researched for information on the vendor's product and similar products. On the basis of the analysis of the bidder's responses, a detailed specification is developed to delineate the requirements of the airline. This specification is used in a subsequent RFP process and becomes a part of the purchase agreement. In response to the RFP, the vendors submit their final proposals, delineating their product's performance, test data, support services, and price.

The evaluation of these final proposals is a key activity in the selection process and usually involves the participation of several functional elements of the airlines. A weighted-guideline approach is often used in assessing such areas as price, technical factors, delivery, and logistics support (field service, warranty, and training).

Separate in-house cost analyses are also conducted to ensure unbiased evaluations, to compute target purchase costs, and to estimate life-cycle costs. The analysis results are used again during purchase negotiations and initial budgeting. The terms and conditions of the proposed warranty and guarantees are also carefully examined, as are the vendor repair costs and turnaround times. Some form of extended warranty is usually included in avionics procurements; however, it is rarely priced as a separate item by the vendors. Most vendors automatically issue a standard warranty with their products, the cost of which is included in the equipment price. Reliability guarantees, however, are usually negotiated separately.

The TSO status of the vendor's product is also significant. If he has obtained the necessary certification, a copy of the documentation is usually requested. If the item to be purchased is a non-TSO item, a full data package may be required, depending on the impact the item might have on type certification of the airline's aircraft.

After the project evaluation group has completed its assessment of the various vendor's proposals, it forwards recommendations to the appropriate review and source-selection authority. The recommendations of the project evaluation group are considered by either a project review board consisting of mid-management personnel or a management review board consisting of upper management. The organization of these boards varies, depending on the project's cost impact and criticality. The review boards narrow the qualified vendors down to two or three, and extensive negotiations are then initiated.

C-4 PROCUREMENT PROCESS

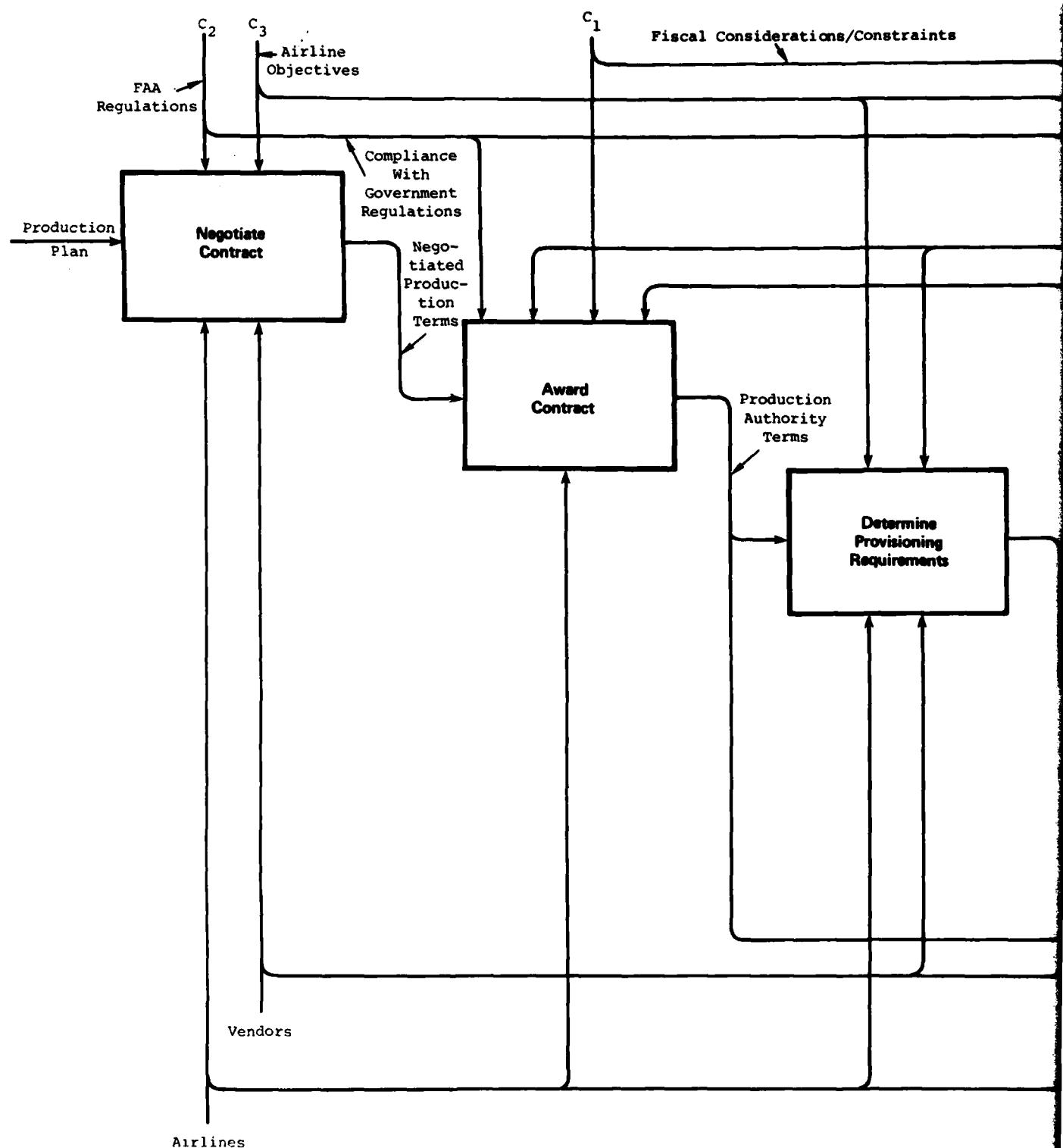
Upon selection of the final two or three bidders by the individual airline, purchase negotiations are conducted and the terms and conditions of the purchase agreements are formulated. The general practice is to make only one award for a selected item; however, it is possible that only initial requirements will be satisfied, with subsequent purchases remaining open for possible competition. The airlines attempt to obtain a long-term price agreement, in which the seller agrees not to increase his price more than a stated percentage. The increases are not automatic and must be justified before airline concurrence is given.

Contract award is made to the vendor who is judged capable, as a result of the negotiations, as best meeting the requirements of the airline. The procurement documentation is assembled and coordinated with management and legal personnel for review and audit. Procurement documents typically consist of the detailed specification, specific agreements and conditions, support requirements, and price and delivery data. The specific terms and agreements are usually based on some general terms and agreements that have been previously negotiated.

After the contract has been awarded, repair-parts provisioning conferences are conducted. Vendor-supplied repair-part information, prepared in accordance with Air Transportation Association of America (ATA) Specification 200, is used as the basis for these conferences. This information includes item description, price, recommended order quantities, and failure rates.

The airlines have been able to secure provisions in their agreements for "buy back" in the event that the manufacturer-recommended spare parts are not used during a specified period. Suppliers are expected to buy back such parts without undue loss to the airlines. They are also expected to maintain stocks of major high-cost components that the airlines may either lease or purchase as demand dictates. Finally, the suppliers are expected to maintain the capability of supplying material as long as the equipment is in commercial air transport service. The airlines view the need to stock repair parts as an expense; thus, if the vendor performs this service in conjunction with the "buy back" provision, the airlines have reduced their cost at minimum risk.

Suppliers are expected to furnish maintenance manuals in accordance with Air Transportation Association of America (ATA) Specification 100 or 101, as well as initial operation and maintenance training at no additional cost to the airlines.

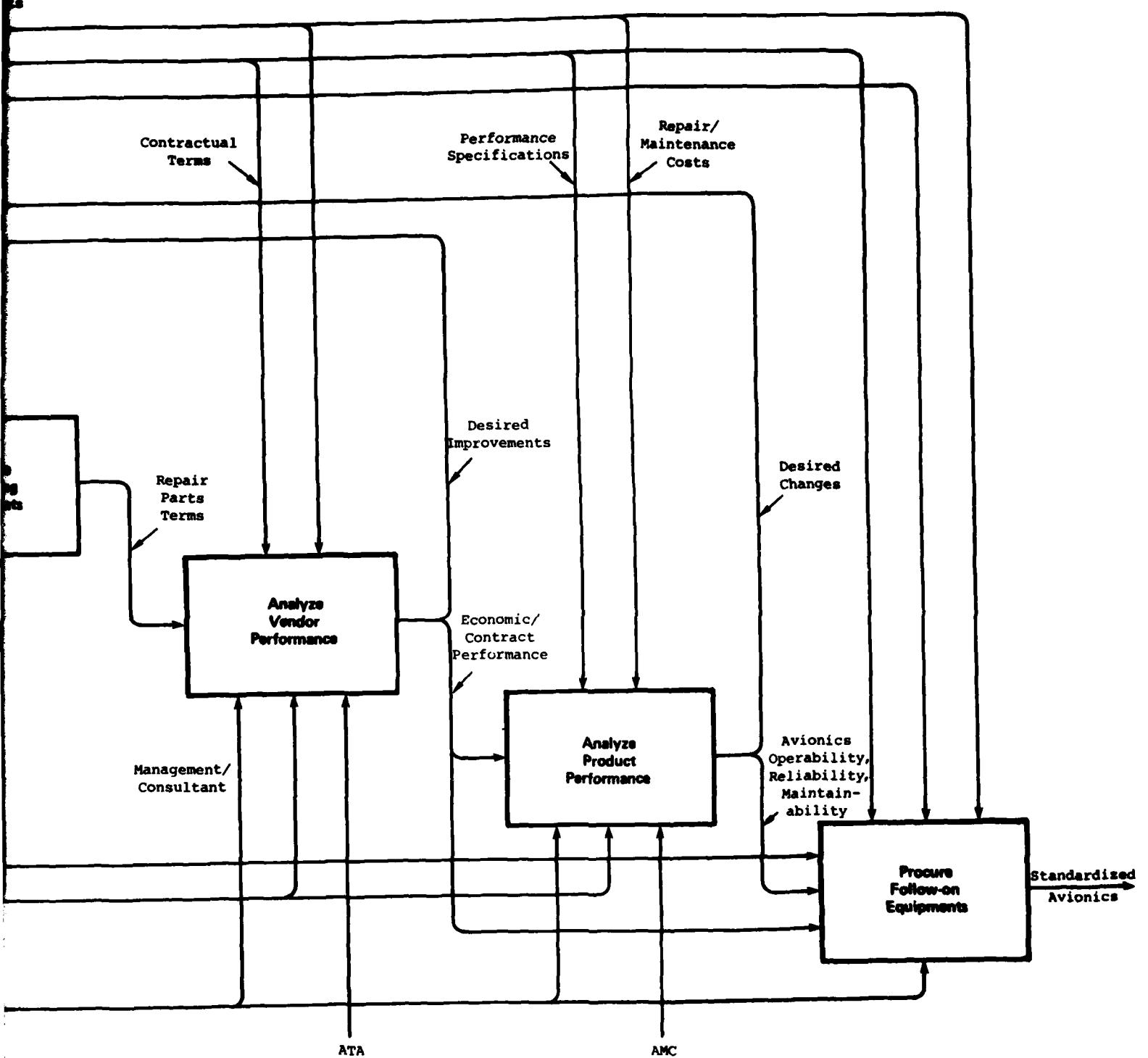


TITLE:

PROCURE EQUIPMENTS

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C-4



The final phase of the procurement process starts with the delivery of the product to the airlines and continues for the life of the equipment. Both the vendor's performance and the performance of his product are continuously monitored throughout this phase. Various economic and contract performance factors are monitored periodically. Audit results affect subsequent procurements with a particular vendor and are the basis for an assessment of internal management.

The product's performance is continuously monitored by several functional groups of the airline. Typically, selected managers establish personal goals for cost reduction and are evaluated with respect to their success in meeting these goals. Therefore, the product is periodically reviewed for potential cost savings. The reviews encompass standardization, in-house versus outside maintenance, discard at failure versus conversion to repair, and item replacement.

Quality-assurance specialists monitor product performance and may suggest modification if prescribed levels are not being achieved. Inventory specialists monitor the stock levels of spare parts and may adjust reorder requirements on the basis of computer economic quantities. Finally, through the conferences and publications of the AMC, product performance is monitored collectively with other members of the air transport industry that use the same product. Trends and specific maintenance problems can often be identified, and solutions shared with other air carriers.

The AMC plays a key role in the CAAM. Because of its importance, the following information is included to amplify the AMC's role. The AMC serves as a forum for the discussion and solution of avionic and electronic equipment maintenance problems of common concern to the air transport industry. Through its elected Steering Group and appointed Task Groups, it provides a continuous medium for the exchange of information among avionics users, installers, manufacturers, and maintenance specialists. Its objectives are promotion of improved aviation electronic systems and equipment reliability and performance.

The steering group is composed of a cross-section of the air transport industry. The AMC secretary, the only permanent member although non-voting provides liaison with and is a member of the AEEC.

Considerable information is produced by the various AMC activities through ARINC under the guidance of the Secretary; it is circulated to avionics maintenance shops of the airlines and other air transport operators, air frame and avionics manufacturers' service departments, and other organizations interested in avionics maintenance. This information is consolidated into a monthly publication called "Plane Talk." Any given issue may contain avionics training and industry meeting calendars, AEEC activities, contributed papers on new test techniques, manufacturers' reports, feedback of airlines and manufacturers from previous AEEC and AMC meetings/reports, "Top Ten" unscheduled removal summaries, and "Service Bulletins" issued by the various avionics manufacturers.

Prior to each annual meeting, the Steering Group solicits and publishes detailed maintenance questions and ideas that may be added to the agenda.

These maintenance items are published as a Program and are then discussed in an open forum. Direct exchange among the members is encouraged and solutions solicited from manufacturers or experienced airline technicians. Several hundred personnel are often present at the AMC Open Forum representing foreign and domestic airline operators, airline maintenance supervisors, airframe manufacturers, avionics and electronic equipment manufacturers, military service and government observers, and interested marketing representatives. A great deal of research and testing by both the airlines and avionics manufacturers often precedes the AMC Open Forum. Solutions are often documented by the manufacturers for each of the maintenance items scheduled for discussion in the form of modification kits and/or service bulletins. This action on the part of the manufacturers represents a significant investment on their part to ensure a viable, satisfactory solution. The open forum approach provides the arena which ensures "life-span competition" and seems to encourage manufacturers to be both responsive and responsible during the last phase of the CAAM. This forum is, in effect, a proving ground that measures the performance of equipment developed from an ARINC Characteristic and the performance and response of the respective equipment suppliers. Partly as a result of this interchange, the original ARINC Characteristic may be supplemented or a new Characteristic generated.

CHAPTER THREE

U.S. AIR FORCE AVIONICS ACQUISITION METHODOLOGY

This chapter describes the U.S. Air Force evolving avionics acquisition and support strategy.

In 1974 the Air Force began a series of initiatives to improve their processes for the acquisition and support of avionics. These initiatives were strongly shaped by the findings of the blue ribbon study, "Electronics-X." The Electronics-X study report observed that there were many features of the commercial airline avionics practices that appeared adaptable for military use, specifically, the following:

- Method of Specification. The use of form, fit, function (F³) specifications to permit the manufacturer wide latitude in implementation of the system and to provide for interchangeability with future systems, or with competitor's systems.
- User-Technologist Dialogue. The use of a formalized process to obtain user, developer, and supporter inputs in the specification and update process. The airlines carry out these functions within the Airlines Electronic Engineering Committee and the Airlines Maintenance Conference.
- Corporate Memory. The establishment of a "corporate memory", which tracks the performance of manufacturers against their promises, and remembers during the next procurement.
- Procurement Methods. The use of procurement methods, including contractual incentives for cost-effectiveness or to improve system performance. The airlines make extensive use of Reliability Improvement Warranties (RIWs) and defer the acquisition of support equipment until the equipment has fully matured.

The Air Force began initiatives to adapt the attractive aspects of all of the above practices. The methodology, as adapted by the Air Force, incorporates many of the procedures originated in the CAAM. The Air Force has implemented this acquisition policy to provide cost-effective, supportable avionics systems that assist the Air Force in accomplishing its mission.

The current status of each of the four broad initiative areas and our prognosis is as follows:

- Method of Specification. The first serious attempt at the emulation of airline practices in developing an F³ specification in open forum was the USAF F³ Inertial Navigation System (INS). The benefits of this endeavor will not be known until after the outcome of source selection early this year, and the INS initial performance in the A-10 is demonstrated. However, it is clear that the specification development has taken too long. Perhaps a more architecturally discrete subsystem, such as an altimeter, might have served as a better initial candidate. A further impediment to F³ standardization across a wide cross-section of USAF aircraft is the lack of a generalized Packaging-Mounting-Cooling (PMC) standard similar to that employed by the airlines (ARINC Specification 600). It is difficult to develop a specification for wide GFE-avionics use when the form factor and thermal environments differ from aircraft to aircraft. The Air Force has taken positive steps toward PMC standardization in 1979 and is likely to continue this effort.
- User-Technologist Dialogue. In 1978 the Air Force published AFR 800-28, Air Force Policy on Avionics Acquisition and Support. Among other very important concepts, it directed the establishment of an annual planning conference for avionics. It was based on the principles of the AEEC and AMC in that it fosters communication between users and technologists within the Air Force. In this respect, it has been highly successful. The Air Force is still attempting to find a method of involving industry directly in the conference. Industry is currently kept aware of the results of the conference through circulation of the proceedings and briefings.
- Corporate Memory. AFR 800-28 also established the Deputy for Avionics Control (DAC) and charged that organization with the responsibility for establishing a permanent data base and evaluation tools. The DAC is a joint AFSC and AFLC organization; however, it has had more success in influencing AFSC activities than AFLC. A data base has been established, drawn from the Avionics Planning Baseline (APB) and several extensions: An Avionics Historical Data (AHD) file for reliability, cost, and performance data and the Configuration Data Summaries (CDS), which catalog space availability and environmental data by aircraft type. The data contained in these files provide an essential supplement to the long-term "corporate memory" for Air Force avionics, since military personnel assignments are typically short, and organizations shift charters repeatedly.
- Procurement Methods. The Air Force has diligently explored commercial practices in contractual incentives such as reliability improvement warranty (RIW) and has extended these applications in other variations, e.g., logistics support cost commitments. The applications have been troublesome because they involve new

practices; however, there appears to be payoffs, e.g., a force wide, standardized avionics subsystem, as the ARN-118 TACAN. As with F³ standardization, there are institutional barriers to the application of new contractual incentives, particularly RIW. The logistics community and some elements of the user community view RIWs as restricting operational flexibility and reducing overall organic support capability. The role of contractual incentives and initial contractor support for avionics should be reconsidered. There are aspects of commercial procurement methods that may be equally attractive for implementation; for example, the smaller extent of documentation required, the ability to continue with the same supplier if performance is satisfactory, and so forth.

The acquisition methodology presented in the following text and diagrams reflects the policy and procedures established in Air Force Regulations 800-2 "Acquisition Program Management", 800-28 "Air Force Policy on Avionics Acquisition and Support", and other applicable regulations. As described above, there are still differences between the intended process and the current status of implementation.

The reader should also be aware that avionics procurement within the Air Force is essentially made independent of the major system acquisition process described in DoD Directives 5000.1 and 5000.2. The acquisition of avionics cumulatively exceeds the established thresholds, yet rarely does any one equipment-type or system-type purchase meet the cost thresholds (e.g., exceptions are JTIDS, GPS). If individual avionics programs meet the cost thresholds established in those directives, then those DoD Directives are applied.

The methodology is illustrated in the following diagrams:

- A-0 Acquire U.S. Air Force Avionics
- A-0A Acquire U.S. Air Force Avionics
- A-1 Determine Requirements
- A-2 Conduct Advanced Development
- A-3 Develop F³ Specification
- A-4 Conduct Engineering Qualification
- A-5 Select Production Source(s)
- A-6 Test and Install Equipment

The methodology basically tracks the strategy used to acquire avionics. The strategy consists of both acquisition and investment strategy and includes the planning and management necessary to implement both concepts.

There are two broad objectives of this strategy -- responsiveness to user needs and improved cost-effectiveness. In the first objective, the Air Force strives for better methods in correlating the far-term effect of current threat predictions and opportunities presented by technology trends in order to permit effectiveness of technology-based programs. The Air Force also attempts to achieve more rapid response to changing needs by pursuing methods to shorten the period between the identification of needs and the achievement of operational capability. To achieve greater cost-effectiveness, emphasis is placed on realistic cost predictions through the use of refined life-cycle-cost (LCC) models, more current and accurate data, and better program definition. The benefits of cost reductions based on traditional cost-quantity discount relationships versus competitive (split-buy) concepts are also considered. Appropriate consideration of deployment and support concepts, including number of bases, locations, maintenance concepts, reliability improvements, and software support, is examined for these alternatives. Optimum cost-effective approaches are pursued by means of operations research and systems analysis techniques to evaluate cost, technical, and other information.

Refined quantitative measures are developed to evaluate the standardization potential of various types of avionics equipment. General selection criteria currently used to judge standardization potential include:

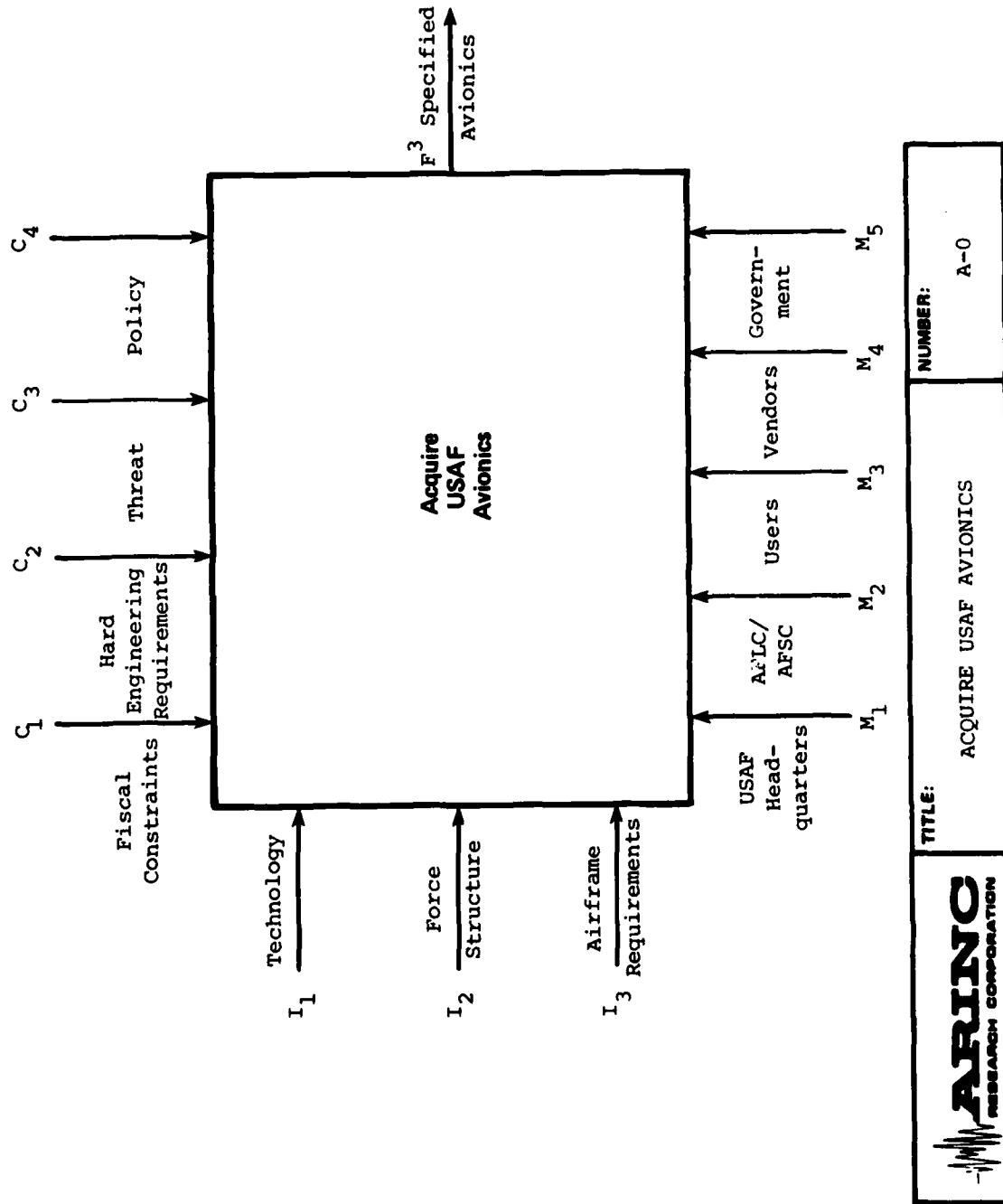
- Technological maturity
- Architectural suitability
- Applicability for multiple aircraft usage
- Economic considerations (economies of scale)

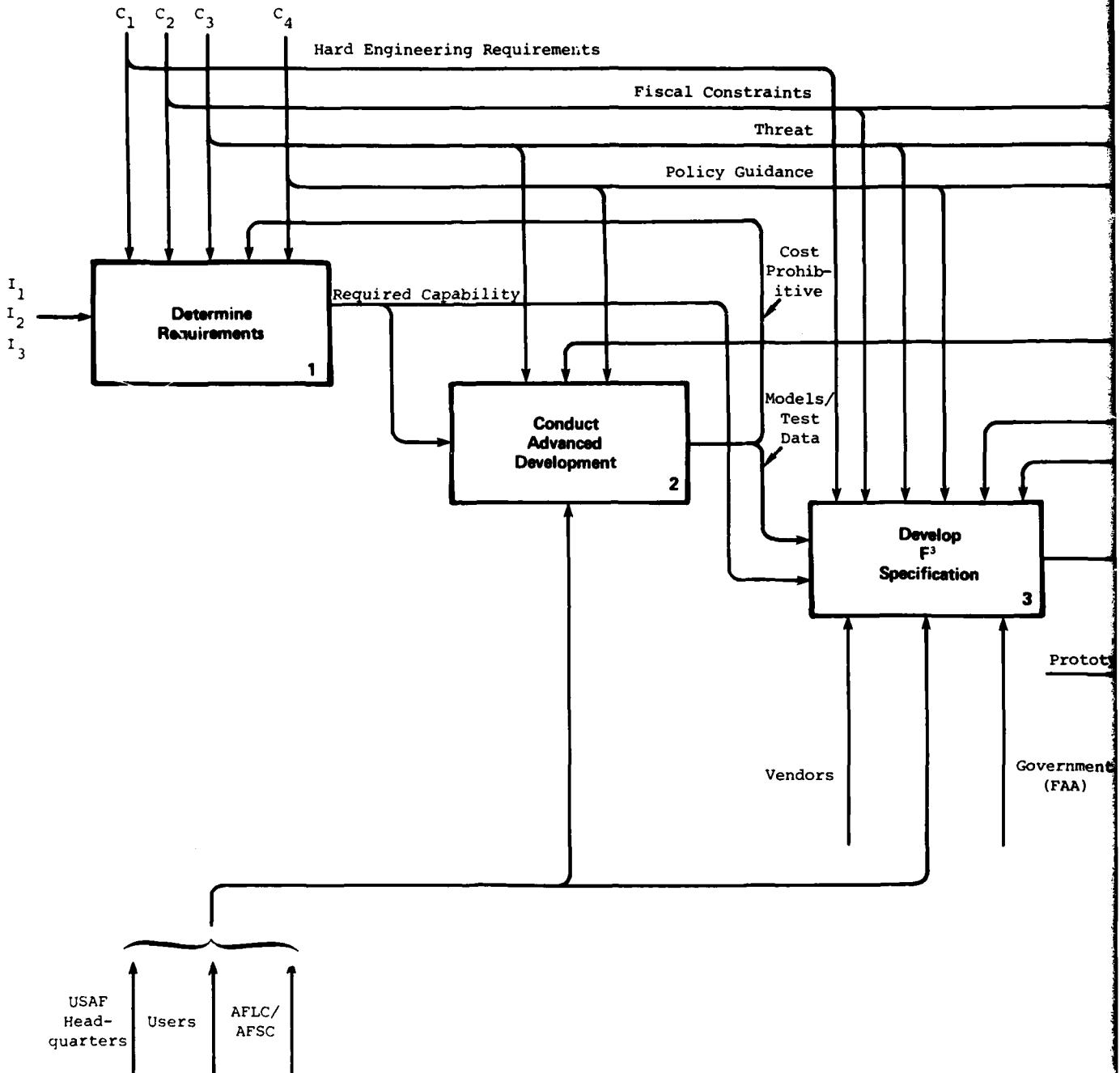
A-0 ACQUIRE U.S. AIR FORCE AVIONICS

The first phase of the process is for the Air Force to develop their mission area analysis or requirements. Participation is initiated by means of annual planning conferences. One of the significant results of these meetings is a series of "road maps" developed to reflect current planning status, investment alternatives, and objectives or goals that are to be pursued. Results of the planning conference are made available to industry. Briefings and exchange of information follow to achieve information cross-fertilization.

These "road maps" heavily influence the need for conduct of advanced development. This phase of the process is considered to be optional, depending on the technology being considered. Given that a requirement exists and sufficient technology is available, an acquisition program is developed. This phase employs the interaction of industry and the Air Force for purposes of developing a "workable" set of requirements. These requirements may range from architectural standards (i.e., MIL-STD-1553) to military specifications or F³ specifications developed in an open forum process.

The promulgation of the requirements is a signal to industry to begin IR&D or to adapt current equipments for Air Force testing. Testing of engineering prototypes is performed to determine which equipments and are the front runners and which sources are considered qualified. From these qualified sources, several may be selected for negotiations. Awards are made and the prototype avionics are developed for installation and initial deployment. The last phase consists of further tests and integration of the avionics into the operational forces.



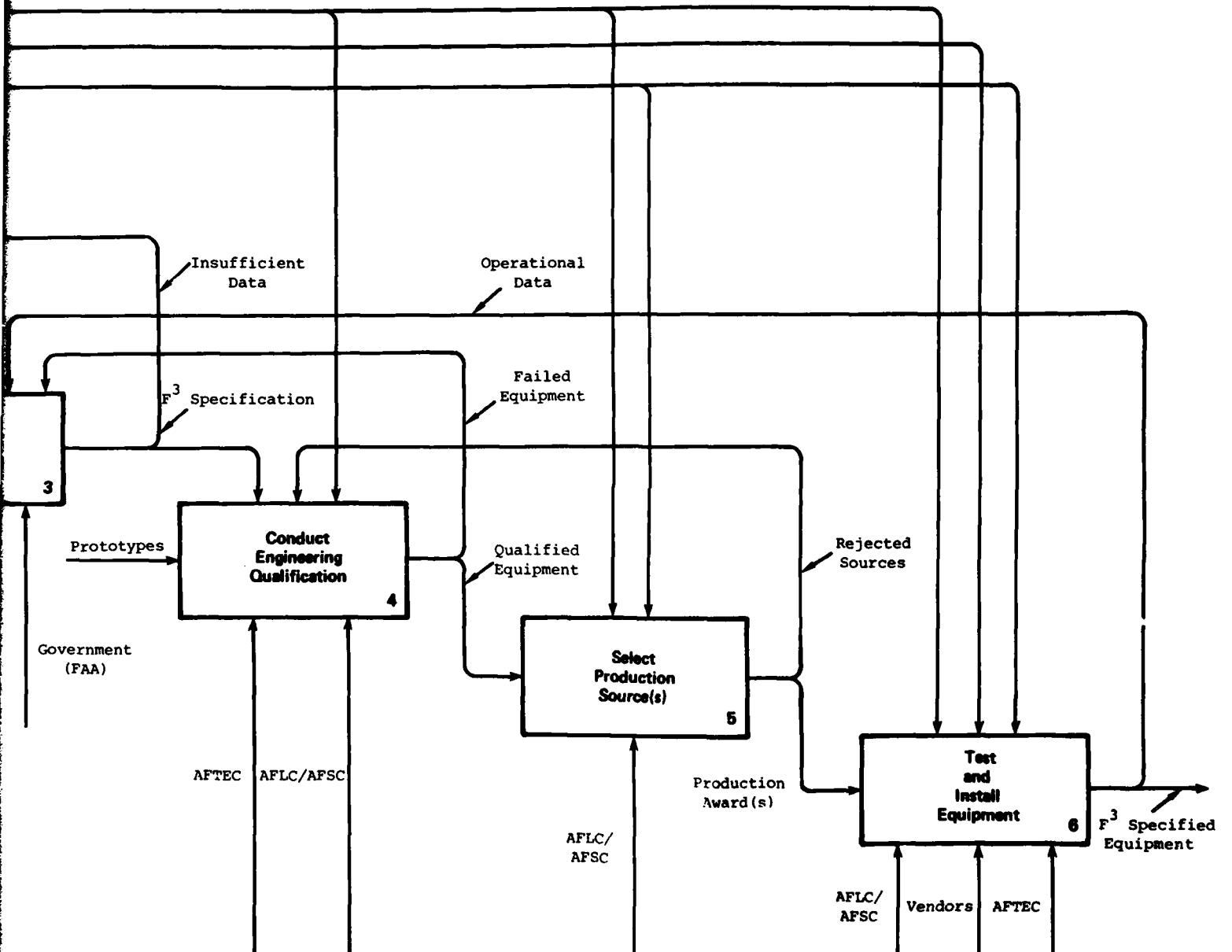


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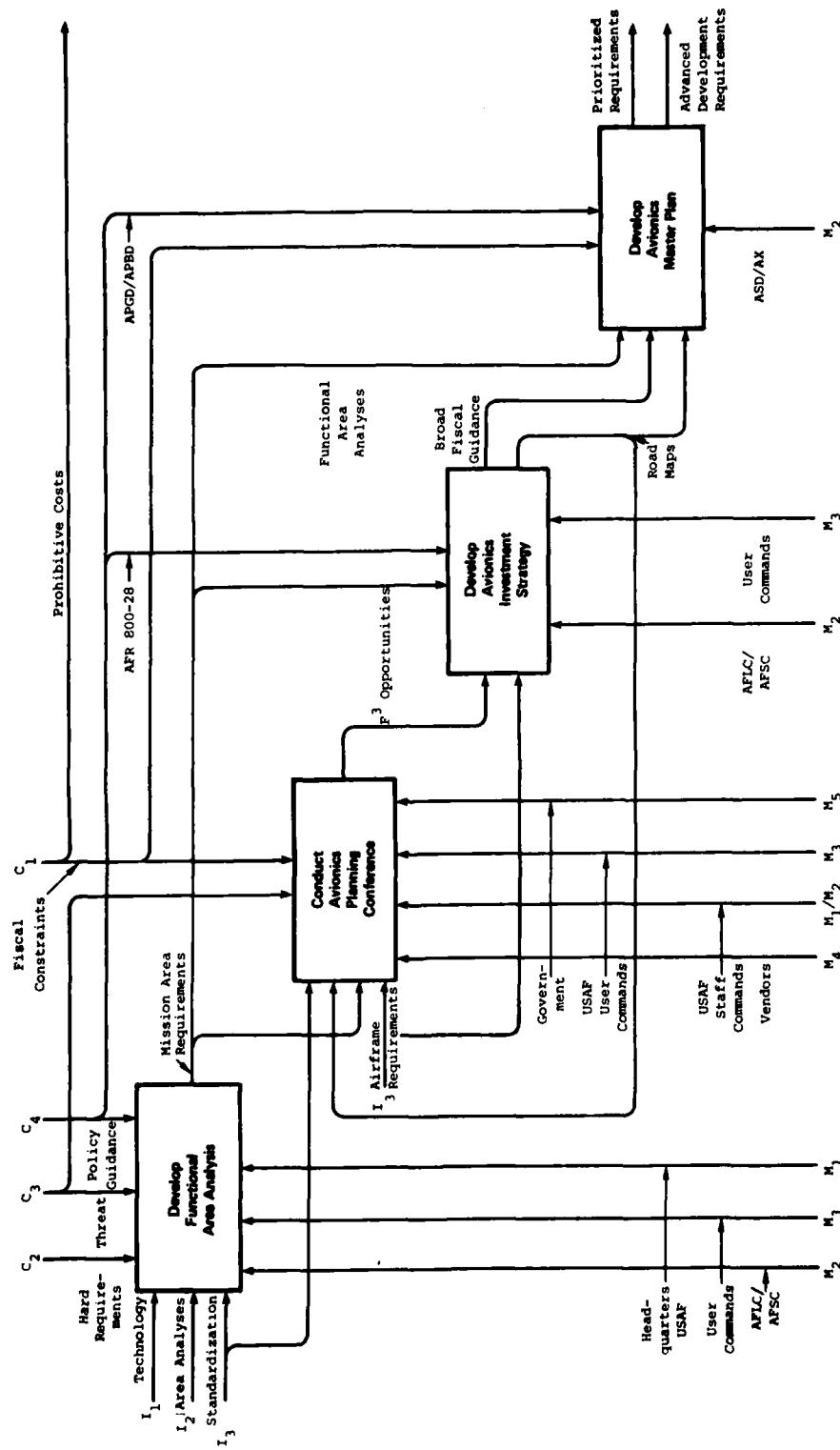
A-0A



A-1 DETERMINE REQUIREMENTS

To meet the established objectives, the Air Force has enhanced communications between the organizations developing and supporting avionics systems. Previously, such activities were individually planned within the responsible organizations' charters. The Air Force perceived a need to coordinate under a single activity -- the Deputy for Avionics Control (DAC) -- the development of an Avionics Master Plan (AMP). The recommendations and options regarding current and future avionics programs are made known to the affected organizations through periodic dissemination of planning documents and at an annual planning conference.

The formal determination of requirements follows the regulation process as established by DoD. The annual planning conference and its subsequent guidance documents represents a means to informally communicate needs in advance of formal budgetary action. This phase assigns the priorities to programs whose immediate accomplishment will provide solutions for meeting the previously developed U.S. Air Force mission area objectives. Since the primary constraint preventing accomplishment of all objectives for any given planning cycle is funding limitations, the requirements determination phase is largely concerned with determining the amount and the priority of projects that can be accomplished to meet the requirements established by the functional area analyses. Emphasis on life-cycle costs, standardization, and maturing technology is made to avoid the proliferation of avionics systems and premature obsolescence.



AFRINC RESEARCH CORPORATION	TITLE: DETERMINE REQUIREMENTS	NUMBER: A-1
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A-2 CONDUCT ADVANCED DEVELOPMENT

A fundamental concept guiding the acquisition of avionics systems for the near future recognizes that neither funds nor manpower will be adequate to carry out the acquisition process in the prevailing fashion. To meet this challenge, the Air Force must rely, to a large extent, on developments that arise in the other military services, within NATO, and within commercial enterprises. Before supporting the development, the DAC will require convincing evidence that the formal guidance contained in AFR 800-22 has been followed, for example:

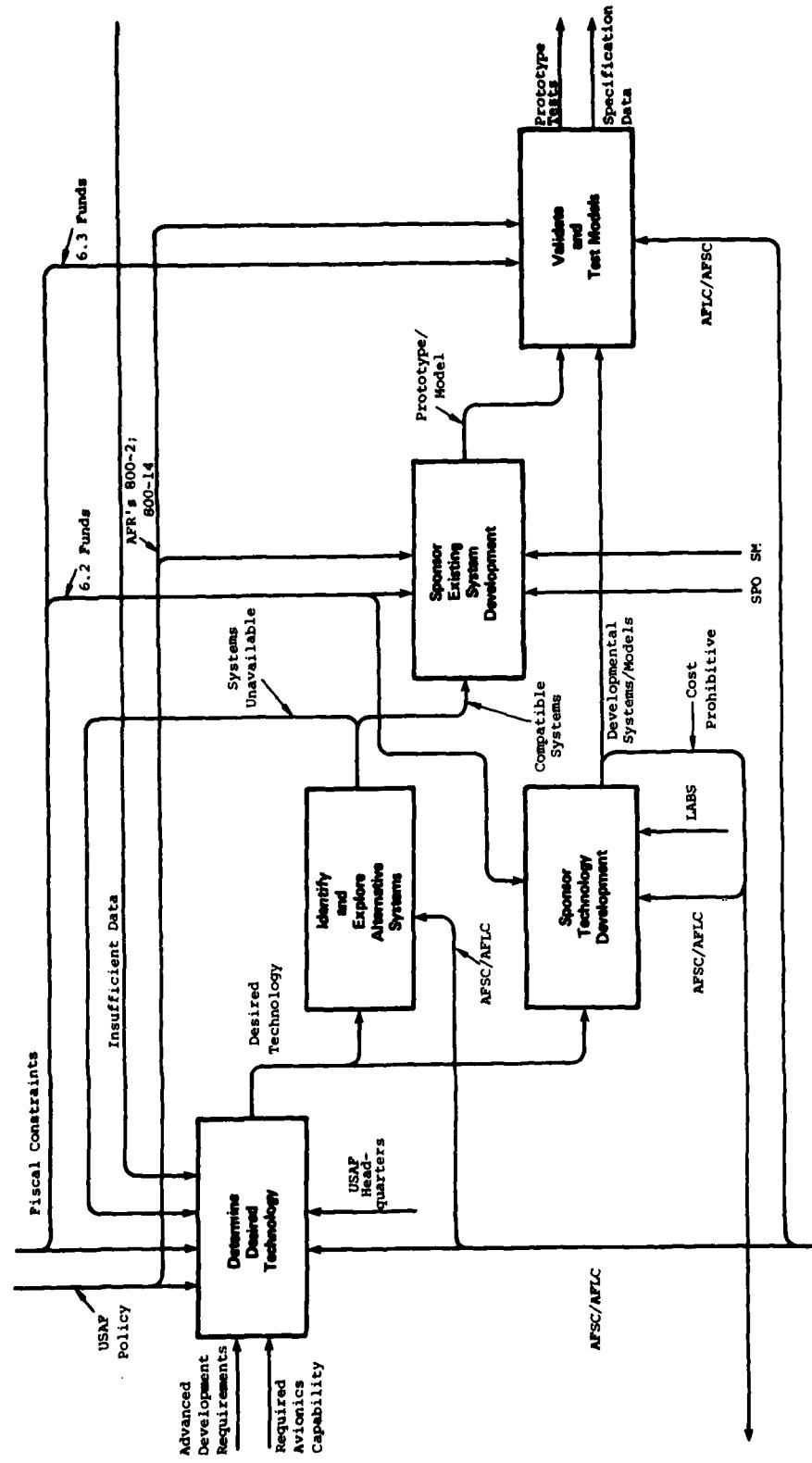
- That the equipments currently designated as Government Furnished Equipment (GFE) standard items have been considered
- That commercially available products, such as those used by the airlines, have been reviewed
- That modification to either of the above sources has been examined, both for technical risk and cost

All of these alternatives provide approaches to reducing peculiar development costs, increasing the production base, and promoting interoperability among the nation's aviation resources. While this concept has been a formally stated position of the DoD for some years, communication of the alternatives among developers and users has been poor. The DAC provides a central point for surveying the activities of avionics development on a national scale. This charter is vigorously implemented to assure a more uniform strategy.

If off-the-shelf avionics are unable to meet the equipment requirements, laboratory programs are reviewed for the adequacy of technology. This review will be conducted in concert with the laboratory directors, with the objective of determining the following:

- If a new 6.2 (Exploratory Development) program should be initiated
- If an existing 6.2 program can be transitioned into 6.3 (Advanced Development)
- If an existing 6.3 program can be transitioned into 6.4 (Engineering Development) with a specific aircraft application in mind

The DAC will not support the latter option without a parallel commitment of modification funds to implement the program.



3-19

The Air Force process of enhanced development in the avionics acquisitions methodology may follow one or more avenues of work. First, the laboratory structure under the Air Force System Command (AFSC) may sponsor exploratory and advanced development of new technologies with funded contracts, which would lead to developmental systems for testing. Second, a vendor, on his own initiative and on the basis of his own market survey, would spend internal research and development (IR&D) funds to achieve the same result. Third, the System Program Office (SPO), System Manager (SM), or aircraft prime contractor sponsors a vendor who has a promising system or approach for a particular requirement.

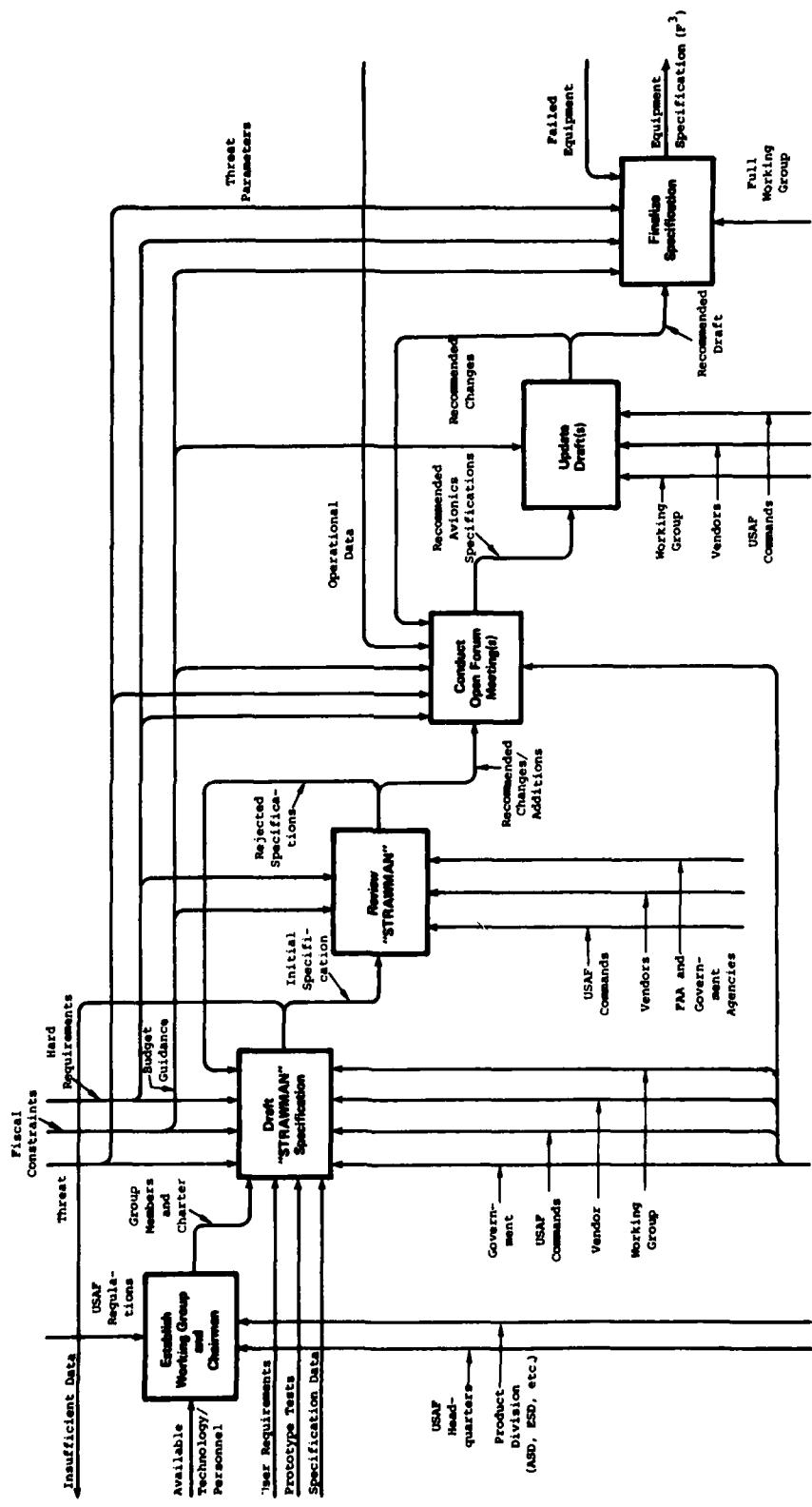
The testing shown in the advanced development process is a requirement generally levied on an avionics vendor before his system can be considered. The tests essentially describe basic performance parameters in a laboratory and flight environment. There is no comparable test sequence in the commercial process, except the testing performed by the vendor on his own. The vendor naturally wants detailed test data on his own equipment, both for sales information and for warranty and pricing considerations. As a result, the vendor's tests may be more extensive (and the results more revealing) than those currently performed by the Air Force. In either case, further testing occurs in later phases to give the parties involved higher confidence in predicting operational success.

A-3 DEVELOP F³ SPECIFICATION

The Air Force specification development process used in the F³ INS process was an iterative one in the sense of "draft, review, and revise". This concept is not entirely innovative as far as military specification development is concerned. The innovative aspects of the USAF specification development process is the early interface and exchange in open meetings with members of industry and the users at large. This concept parallels that of the AEEC open forum found in CAAM. The advantage of evoking this methodology to develop a specification is (1) it can use the open forum process to develop the specification while evoking vendor investment and shortened lead-time development, (2) it can take advantage of the vendor's internal testing process and data to reduce its own testing requirements, and (3) it can take advantage of the F³ benefits that can accrue through the concept of interchangeability.

The structured process in diagram A-3 illustrates the orderly planning of an F³ specification. The diagrams have been constructed to avoid discussion of time required to accomplish each function within the process. This was intentional because of the variations that can occur when applying the process to differing avionics. What must be understood and recognized when following the diagrams is that some overlap may occur between the five top-level processes that constitute this acquisition methodology. In the case of specification development, there exists concurrent events directed toward source selection, equipment tests, and installation that affect the specification development. Specifically, the testing required by the Air Force prior to authorizing production often inputs the specification development. Whether these tests are self-generated by the vendor or mandated by the Air Force, their impact on specification development could be the same.

The process described in the preceding paragraphs is the current policy of the Air Force. Following a closer examination of their experience to date, there have been suggestions that some further benefits can be gained by "fine tuning" the process. The F³ process warrants further study because of the difference in application concerning the AFSC development goals and the Air Force Logistic Command (AFLC) modification program. The F³ concept has proven ideal for mature technologies and a large marketplace. It would potentially gain broadly based user and manufacturer consensus, allow achievable specification development, and provide life-cycle-cost control methods.



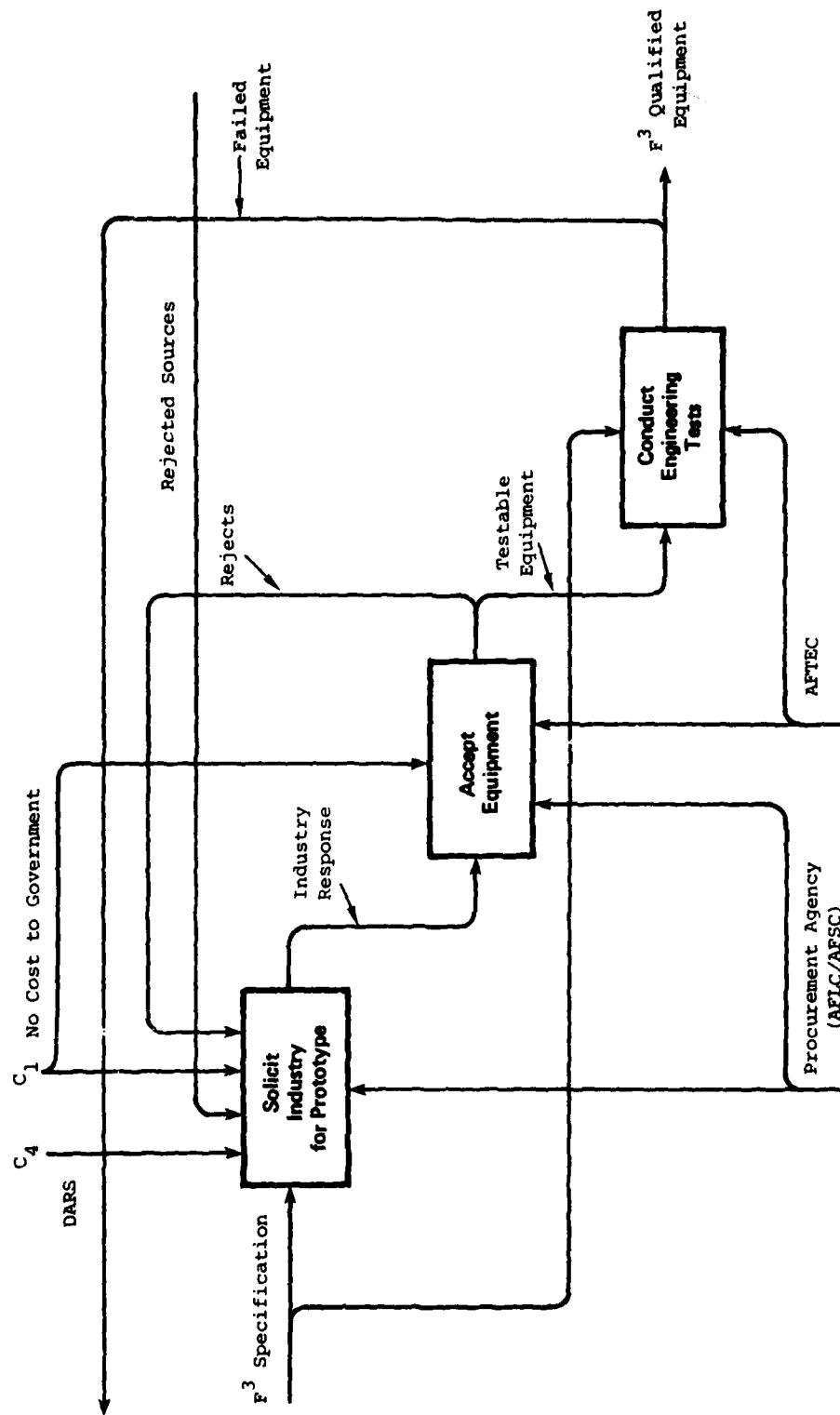
PARRINC RESEARCH CORPORATION	TITLE: DEVELOP P ³ SPECIFICATION	NUMBER: A-3
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A-4 CONDUCT ENGINEERING QUALIFICATION

This phase of the methodology is used to determine the number of interested vendors. In some cases the market may be such that numerous vendors will seek to participate in the competitive procurement. In those cases this phase requires interested vendors to produce at least one prototype equipment built to the F³ specification. These prototypes are employed by the Air Force for testing purposes.

Equipments that are determined to pass all F³ specification requirements will qualify for further funding consideration. Failed equipments will be returned, and the vendors disqualified until an F³-acceptable equipment is produced. The engineering tests are sponsored by the procurement agency and conducted by the Air Force Test and Evaluation Center. Successful integration testing is the basis for proceeding with production and installation.

Cases exist where the market is perceived by industry to be limited because of either the investment costs or the technology required. Limited interests may suggest that an open forum process will not be effective, and an F³ specification is probably inappropriate.



APRINC RESEARCH CORPORATION	TITLE: CONDUCT ENGINEERING QUALIFICATION	NUMBER: A-4
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A-5 SELECT PRODUCTION SOURCE(S)

The source-selection process is one that is relatively constrained by the DoD and Defense Acquisition Regulations (DARs). These regulations govern contractual agreements dealing with the expenditure of public funds. Although specific controls are placed on procurement decisions, several innovative processes for enhancing the return on investment have been implemented.

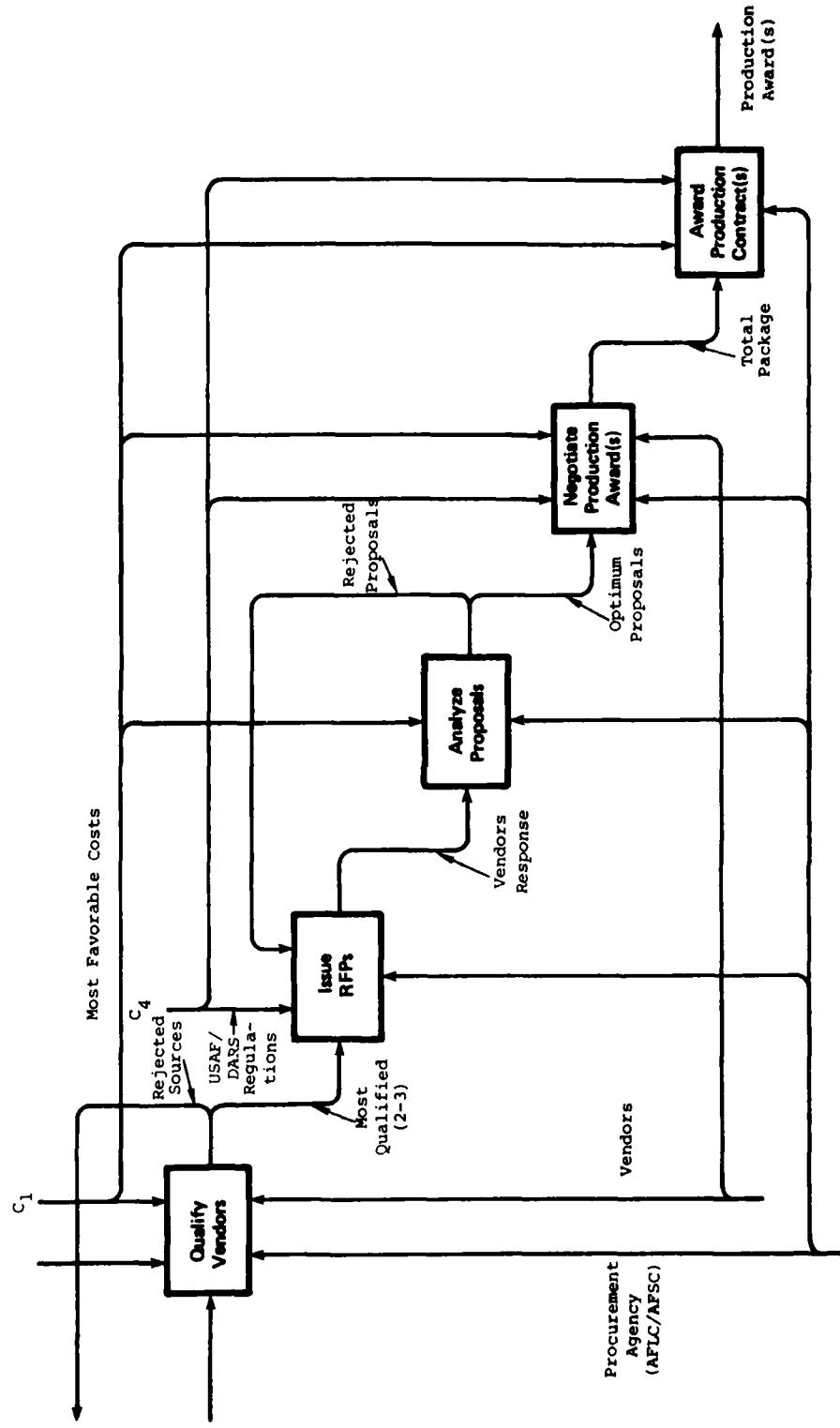
The DoD policy of encouraging competition in all procurements has been supported by the DAC. When there is insufficient time to establish multiple sources for acquisitions, or in the interest of standardization, it may be desirable to follow on with a current contractor. In such cases, the DAC will review other acquisition strategy measures proposed by the program manager to control costs. The options to be considered are as follows:

- Concept of leader-follower development
- Use of F³ specifications
- Purchase of data rights for future procurements
- Use of contractual incentives, such as reliability improvement warranties (RIWs) or logistics support cost guarantees (LSCGs)

To assist in the evaluation of options for acquisition strategy, the DAC maintains a current avionics data base for costs, reliability, and other technical data. The DAC will also develop trade-off models that consider the force-wide effect of options that are related to standardization.

The acquisition strategy for each avionics-related program is planned, controlled, and implemented by the individual program (AFSC) or modification (AFLC) manager. Their strategies are coordinated by the DAC to ensure that the appropriate acquisition strategies outlined in the AMP are pursued. The DAC maintains a current file on the status and objectives of all avionics programs with the AFSC and AFLC.

The creation of several markets is possible, depending on the type of avionics being procured and its applicability to various airframes. Frequently, the procurements will be negotiated by the individual program offices or logistic commands. These commands will negotiate their procurements with approved vendors in accordance with the specifications. Splitting the buy serves several purposes. The threat of competition is



3-23

much more credible if several manufacturers are in production at the same time. Performance data on the alternative equipments can be compared under similar operating conditions early in the acquisition cycle. Should one of the equipments fail to perform as desired, the alternative sources can be brought in before the bulk of production requirements have been procured.

In some cases, the market size is such that only one manufacturer can be sustained, or there are obvious advantages in making the initial buy from a single source. In this option the DAC will assign a single agency the responsibility for coordinating the AFSC and AFLC requirements and negotiating the buy.

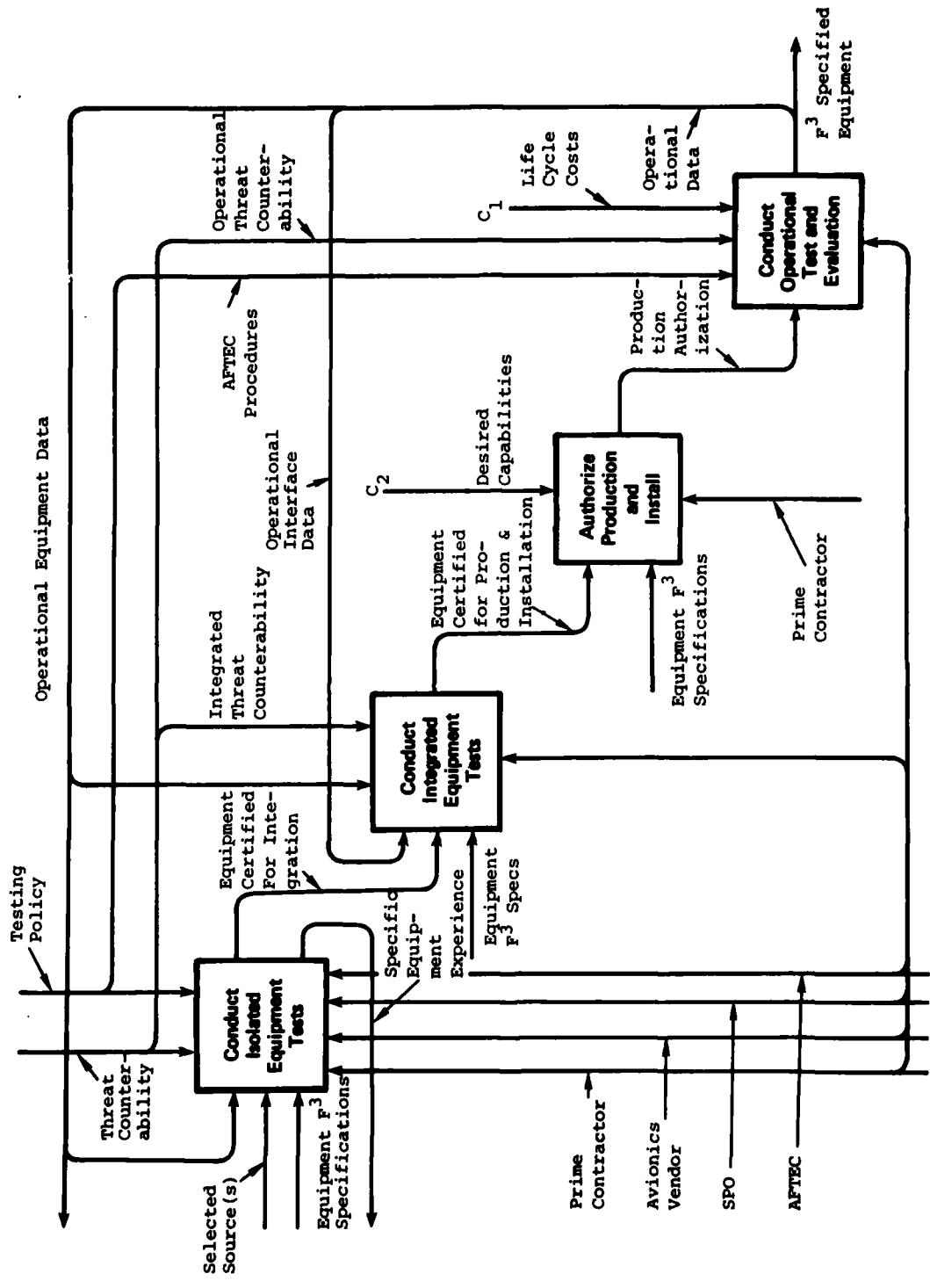
A-6 TEST AND INSTALLATION EQUIPMENTS

Testing and installation of avionic equipments produced to specifications remain an important part of the acquisition strategy. Test and Evaluation (T&E) will continue to be an integral part of the development of avionics systems. The overall T&E planning objective -- to provide the capability for realistic assessment of avionics effectiveness and suitability -- is achieved with due regard for the planned systems addressed throughout the Avionics Master Plan. The tests illustrated in diagram A-6 are those required to certify that the avionics have been designed and produced to the specifications. Once these tests have been completed, the authorization for mass production can be given with confidence that the hardware and associated software will, in fact, provide the capability designated in the specifications.

Some of the goals or attributes that have been incorporated in the T&E efforts for this acquisition methodology are as follows:

- Early user involvement in T&E
- Increased confidence level, accuracy, and economy in testing
- Broader scope in testing
- Reduction in test time

The Air Force is in the process of undertaking several studies that would provide the responsible managers with the information necessary to approve those avenues that can be implemented to accomplish these goals. Of these goals, the major thrust has been directed toward (1) clarifying the T&E structure, policies, and procedures within the T&E community; (2) determining the T&E requirements and the current Air Force capability to meet these requirements; and (3) determining the extent of the testing capability required by the Air Force to evaluate avionics in a simulated field environment. The testing continues to varying degrees during the operational life cycle of the avionics to ensure its capability, survivability, and longevity.



11

TEST AND INSTALL EQUIPMENT

A-6



CHAPTER FOUR

NAVY SYSTEMS ACQUISITION METHODOLOGY

The CSA program is in the process of investigating several management and technical issues raised relative to the incorporation of combat system architecture in the design of future combatants. As such the CSA program is in a state of transition until the organizational and conceptual precepts of the program are identified. This study represents an effort to develop new concepts which may become part of the overall CSA program effort.

This chapter describes the Navy systems acquisition methodology. Discussions with CSA program personnel indicated that a CSA program acquisition methodology has not been established. Therefore, in lieu of a CSA program acquisition methodology, this chapter will describe the Navy acquisition methodology. This methodology will be used throughout the remainder of the report as being representative of the policy and procedures that would be used by the CSA program. The methodology described is governed by detailed functional regulations for DoD acquisition of materials, supplies, and equipment and is representative of the acquisition of a command and control system. Serious attention is focused on program reviews at pre-determined key milestones during the systems acquisition process. During these reviews, consideration is given to program issues such as mission and performance requirements, acquisition strategy, schedule, program risks, cost, and logistics. The outcome of each review is a decision to proceed to the next phase of acquisition or the identification of deficiencies, with direction to be followed before proceeding to the next phase.

The acquisition process is shown as an overview in diagram N-0. Additional detailed descriptions of each phase of the process are shown as diagrams N-1 through N-5. Various functional elements of this process are presented in the informational diagrams. These are provided to enhance the reader's understanding of each element. The following is a list of diagrams presented in this chapter:

- N-0 Acquire Navy Systems
- N-0A Acquire Navy Systems
- N-1 Perform Conceptual Studies
- N-1II Informational Diagram: Mission Element Need Statement

- N-1I2 Informational Diagram: Navy Systems Acquisition Levels
- N-1I3 Informational Diagram: Determine Program Milestone Review Responsibility - DSARC Milestone 0
- N-1I4 Informational Diagram: Decision Coordinating Paper (DCP)/Navy Decision Coordinating Paper Content
- N-2 Explore Alternative Systems Concepts
- N-3 Validate and Demonstrate Competitive Systems Concepts
- N-3II Informational Diagram: Prepare and Conduct Milestones I, II, and III Reviews
- N-4 Develop Engineering Development Models
- N-5 Develop Production Models

The process highlighted is that of a major Navy acquisition program, acquisition categories (ACAT) I and II. These categories have a minimum estimated RDT&E cost in excess of \$20 million, or an estimated production cost in excess of \$50 million. Acquisition categories III and IV are defined as less significant programs because the RDT&E costs and production costs are lower than those of ACAT I and II programs. ACAT III and IV follow the same general theme but differ in the decision authority over the program and the formality of each functional element of the overall acquisition.

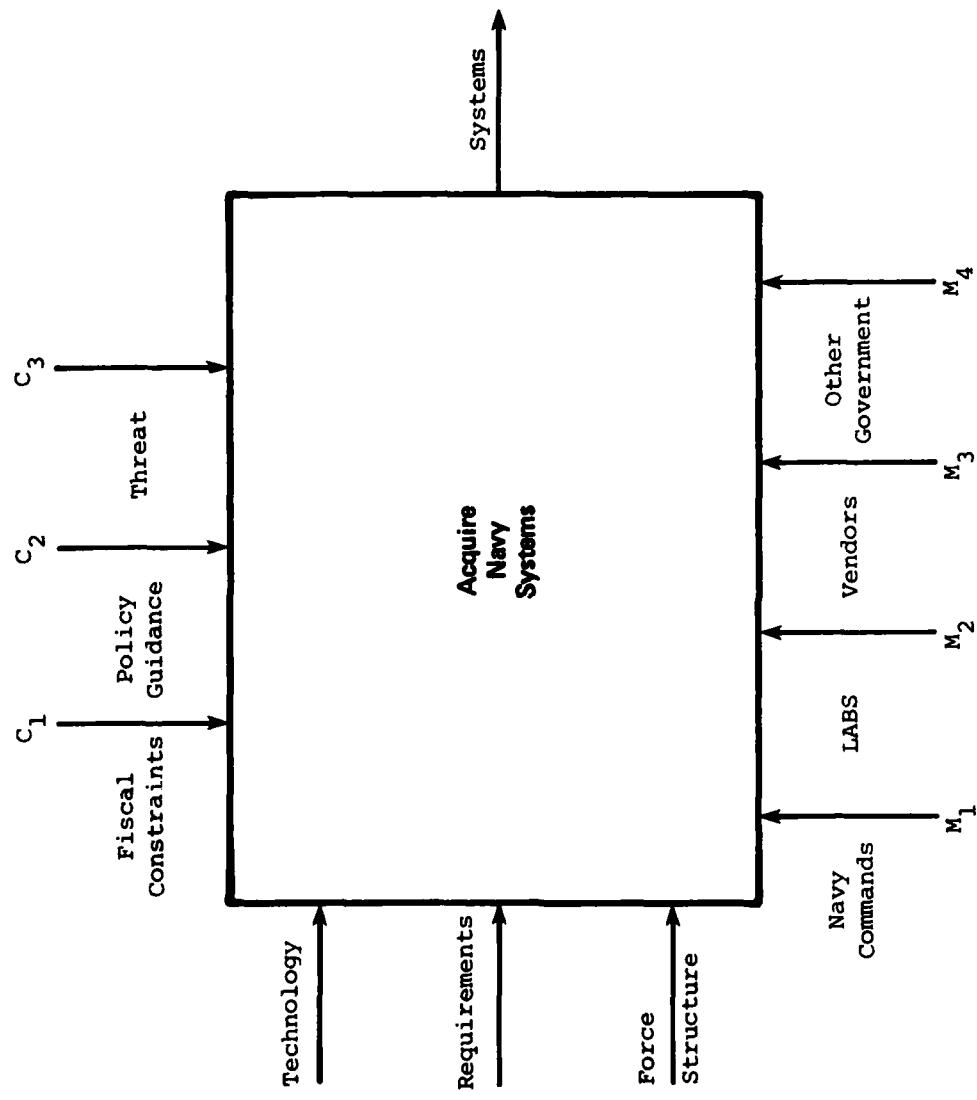
N-0 ACQUIRE NAVY SYSTEMS

The methodology shown consists of five distinct phases:

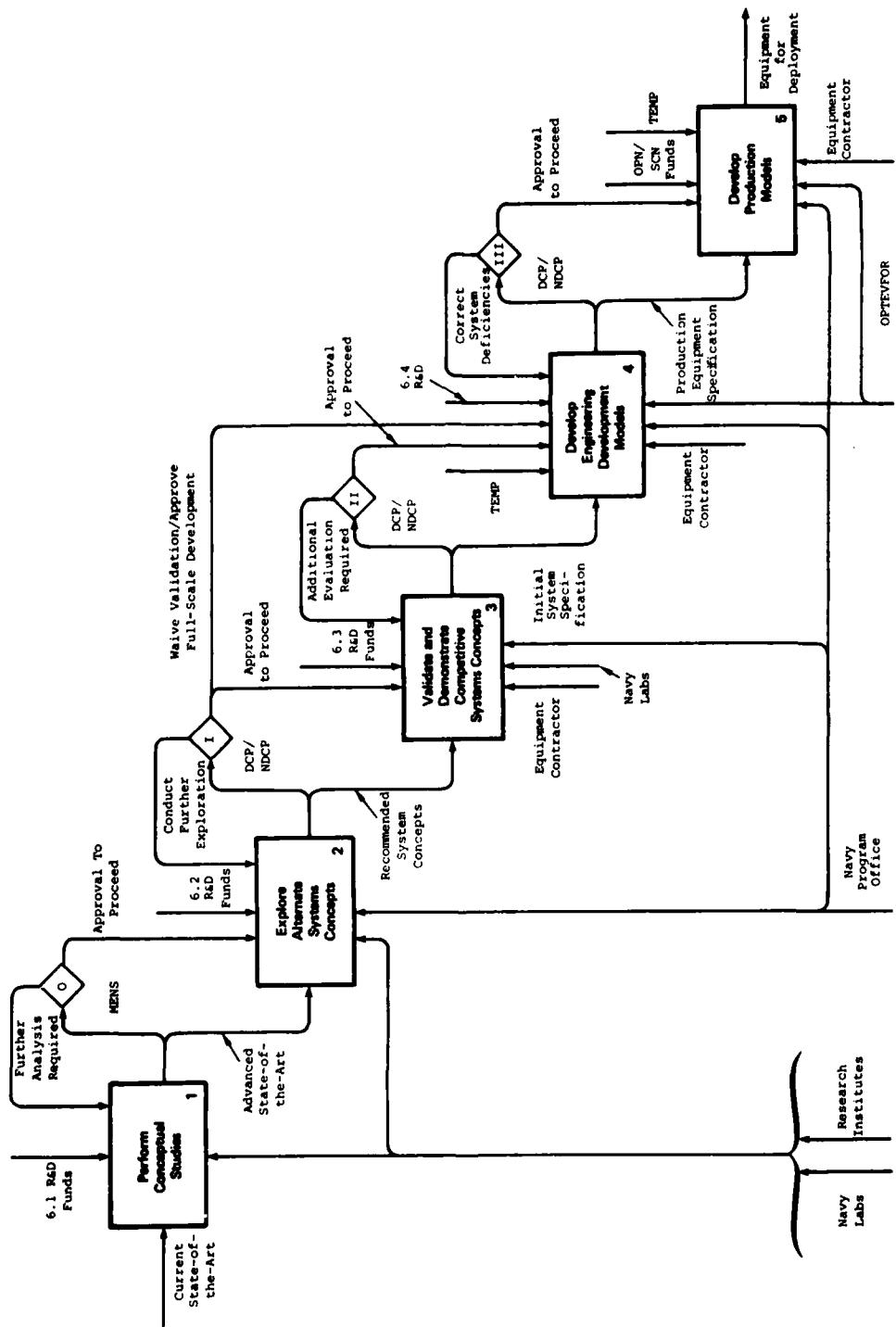
- . Pre-Milestone 0 - Develop and reconcile mission needs
- . Conceptual Phase - explore alternative system concepts
- . Demonstration and Validation Phase - validate and demonstrate competitive system or subsystem concepts
- . Full-Scale Engineering Development Phase - develop engineering development models
- . Production and Deployment Phase - develop production models

Each phase has a specific output in terms of technical advancement, program documentation, and equipment. These outputs become inputs for conduct of the next phase; the review between each phase provides the approval to proceed.

As the acquisition progresses, conceptual ideas become concepts and the validated concepts are developed into system models, and after successful testing, into production models.



AURINC RESEARCH CORPORATION	TITLE: ACQUIRE NAVY SYSTEMS	NUMBER: N-0
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Diamond = DSARC/DNSARC Milestones

Acquire Navy Systems

TITLE: ACQUIRE NAVY SYSTEMS	NUMBER: N-OA
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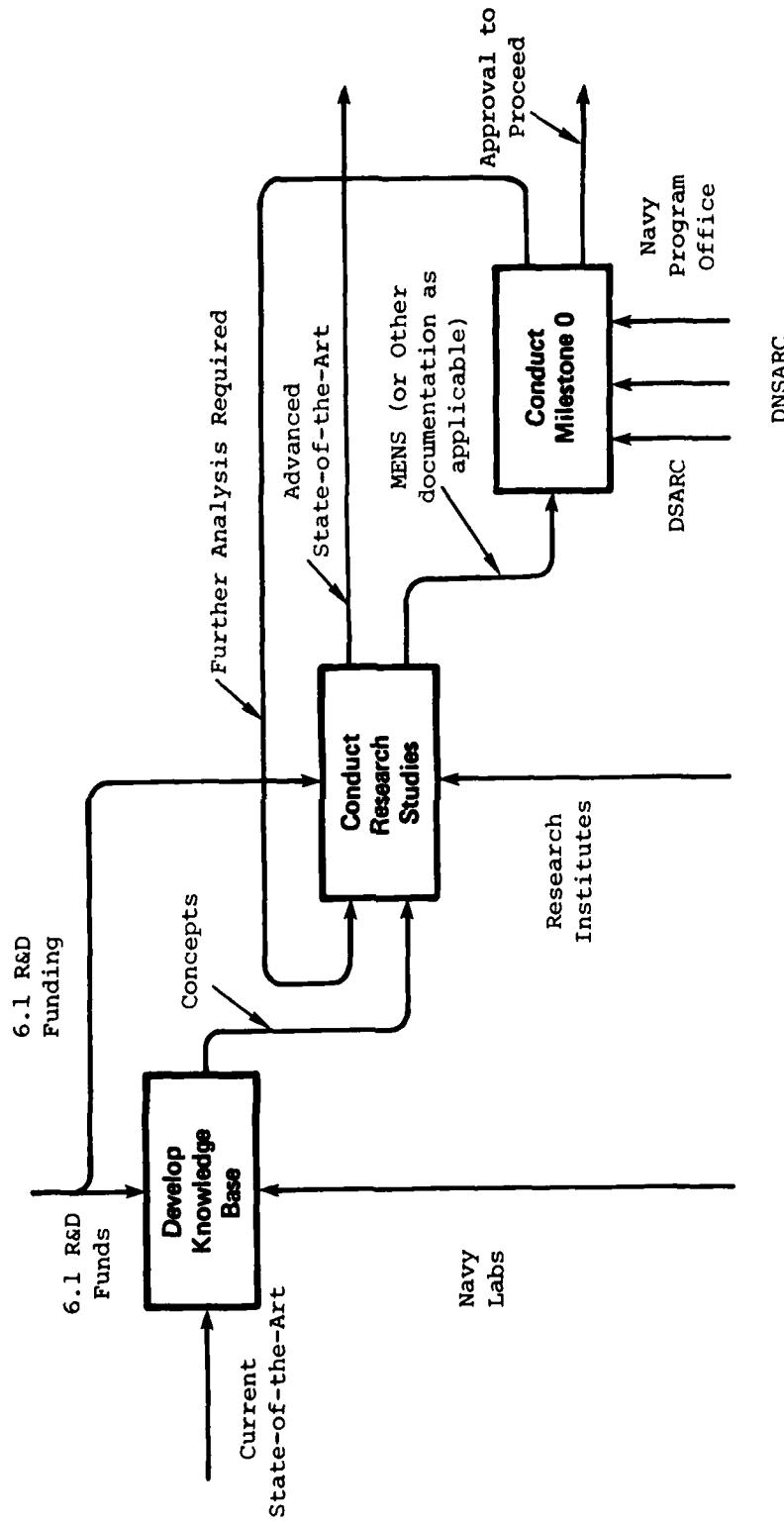


N-1 PERFORM CONCEPTUAL STUDIES

The purpose of this phase is to conduct scientific study and experimentation directed toward increasing knowledge and understanding as related to long-term national security needs. The efforts sponsored are intended to provide fundamental knowledge for solving identified military problems. As such, these efforts provide part of the base for subsequent exploratory and advanced development of systems in defense-related technologies in such areas as communications, detection, tracking, surveillance, propulsion, mobility, guidance and control, and navigation. These efforts extend from the determination of a need for an operational capability to the program-initiation decision that authorizes exploratory development.

The first process is to develop a knowledge base in an area of current state of the art to be advanced. Prime participants in accomplishing this objective are Navy laboratories, such as Naval Surface Weapons Center (NSWC), Naval Research Laboratory (NRL), and Naval Surface Research and Development Center (NSRDC). Non-Navy participants would include universities or research institutes with background and experience in the area under consideration. The result of this initial effort is the development of concepts for further research, centering on advancing the state of art.

Concepts that are accepted by the Office of the Secretary of the Navy (SECNAV) become subjects for the conduct of these research studies. Prime participants in accomplishing these studies could again be Navy laboratories, universities, and research institutes. Conceptual effort is normally continued at the discretion of the Department of the Navy (DN) until such time as it is determined that a system acquisition program should be pursued. These efforts involve a highly iterative process, with the activities performed simultaneously or sequentially since the basis for the acquisition is established by policy, fiscal, analytical, experimental, and engineering efforts at the various levels within the DN.

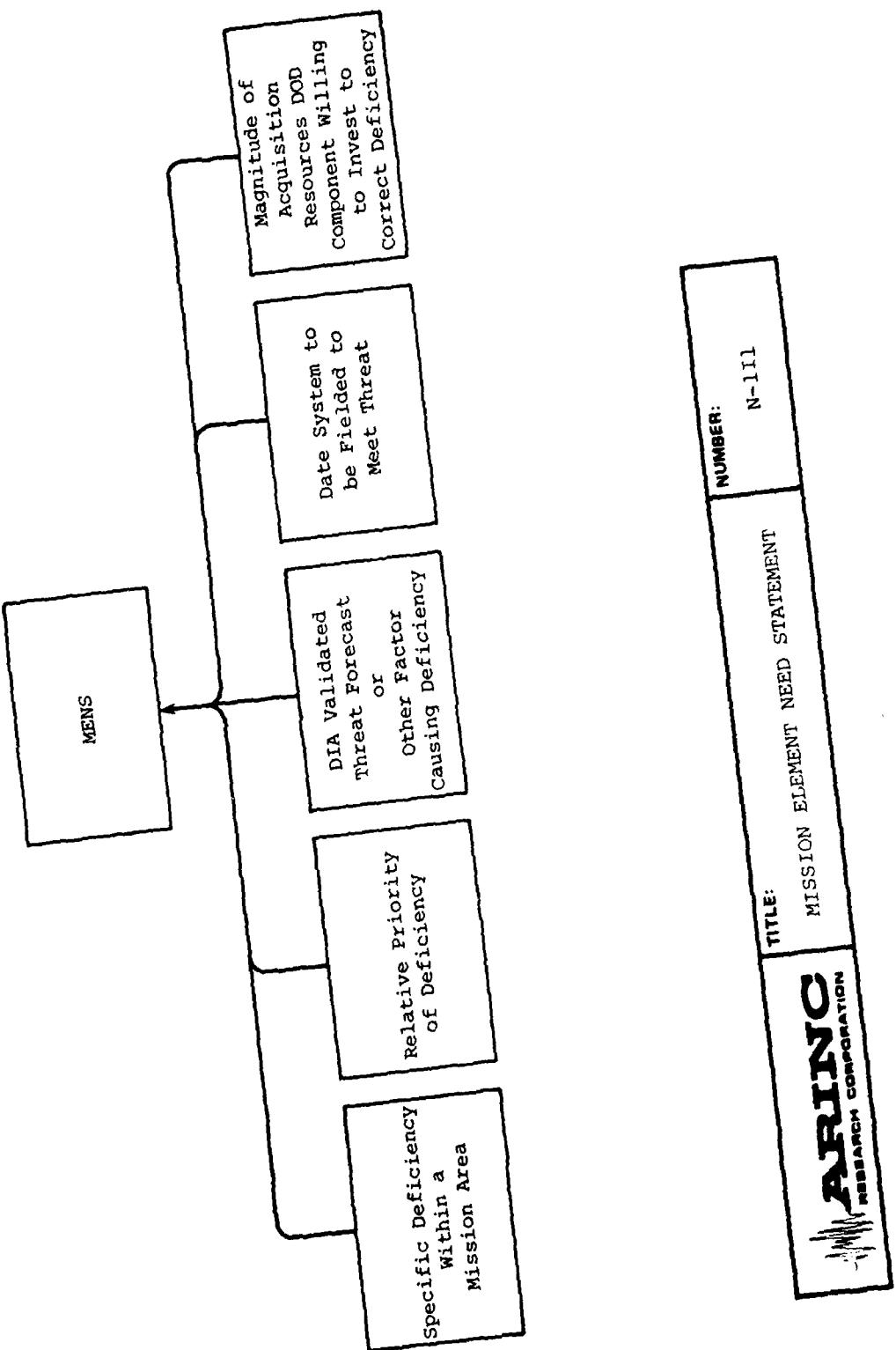


ARINC RESEARCH CORPORATION	TITLE: PERFORM CONCEPTUAL STUDIES	NUMBER: N-1
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N-1II1 MISSION ELEMENT NEEDS STATEMENT

The considerations that support determination of the need for a system program, together with a plan for that program, are documented in the Mission Element Needs Statement (MENS). The MENS is required for each acquisition, including system modifications and additional procurement of existing systems, which are anticipated as costing in excess of \$100 million (FY 1980 dollars) in Research, Development, Test, and Evaluation (RDT&E) funds, or \$500 million (FY 1980 dollars) in production funds. The MENS is not required for programs, regardless of size, directed toward developing and maintaining a viable technology base. As shown in diagram N1II1, the MENS defines the following:

- The mission areas addressed
- The nature of the need in terms of mission capabilities required without reference to the characteristics of a hardware or software system
- The basis for the need in terms of an anticipated change in the projected threat or in terms of an exploitable technology
- The existing and planned DoD or allied capabilities to accomplish the mission
- The evaluation of the ability of current and planned capabilities to cope with the projected threat
- Key boundary conditions for satisfying the need, such as:
 - .. Timing of need
 - .. Relative priority with the mission area
 - .. Order of magnitude of resources the DoD component is willing to commit to satisfy the need identified
 - .. Logistics, safety, and manpower considerations
 - .. Standardization/interoperability with NATO, as well as among the DoD components
- An approximate schedule and an estimate of resources to be programmed, together with the approach proposed for developing alternative concepts for presentation to the SECDEF at Milestone I



N-1I2 NAVY SYSTEMS ACQUISITION LEVELS

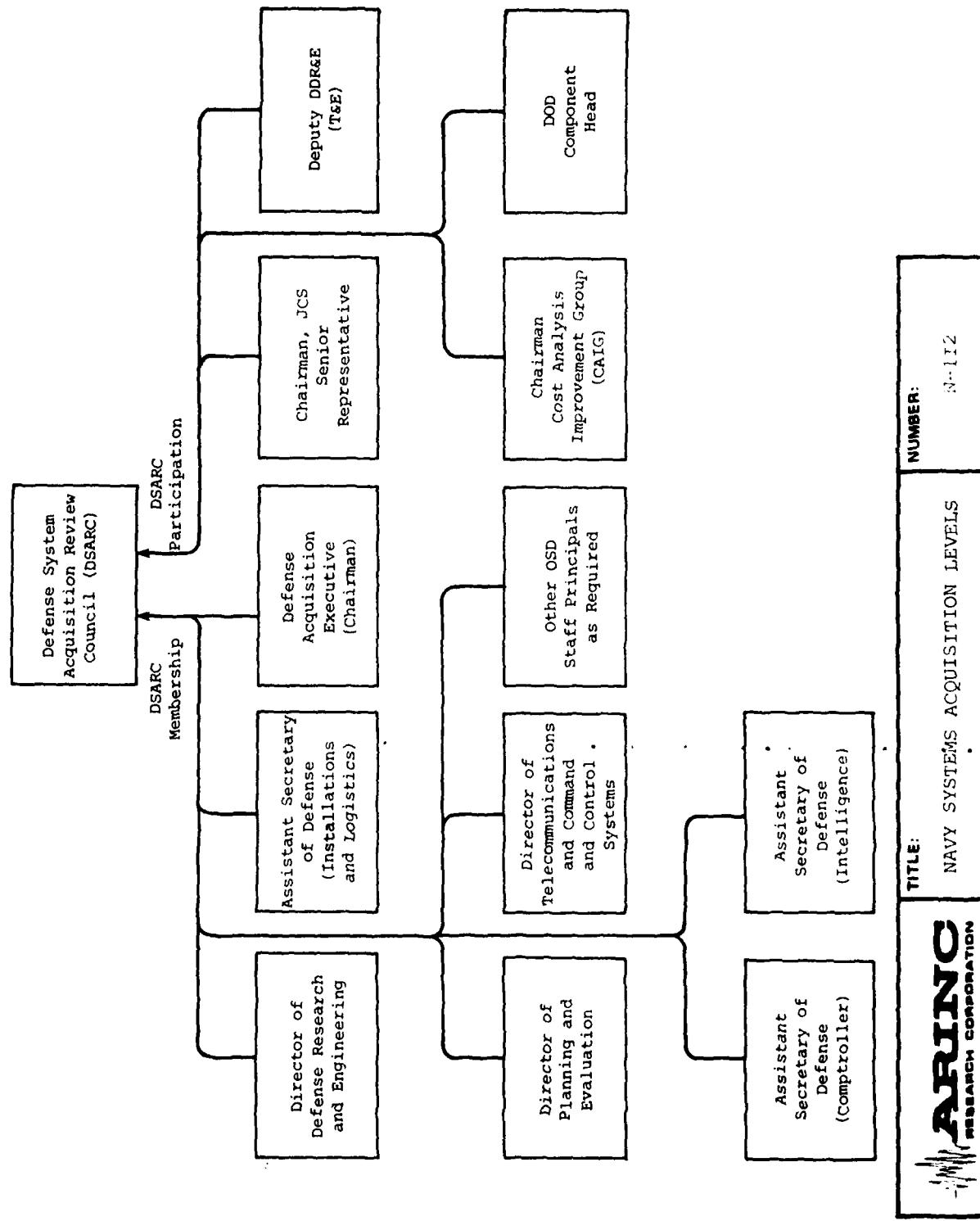
Major programs within the Department of the Navy are those having an estimated RDT&E cost in excess of \$50 million, or an estimated production cost in excess of \$200 million, and such other programs as SECDEF/DEPSECDEF designates. As defined in OPNAVINST 5000.42A of 3 March 1976, this program is classified as an ACAT I program. ACAT I programs are reviewed first at the CNO/SECNAV level and then at the SECDEF/DEPSECDEF level. SECNAV receives advisory support from the Department of the Navy Systems Acquisition Review Council (DNSARC) for all programs for which the Secretary of Defense (SECDEF) is the decision authority and for other programs designated by SECNAV. The purpose and organization of the DNSARC are structured similar to those of DSARC.

The function of DSARC is to serve as an advisory body to the SECDEF on the acquisition of major defense system programs and related policies and to provide supporting information and recommendations when decisions are necessary. The DSARC employs the use of the Decision Coordinating Paper (DCP) in a formal DoD management and decision-making system for the acquisition of major systems. Reviews by the DSARC are intended to provide open discussion of issues and alternatives by DoD officials.

Other programs below the ACAT I level that have an estimated RDT&E cost in excess of \$20 million, or an estimated production cost in excess of \$50 million, or other programs so recommended by the Chief of Naval Operations (CNO) or Chief of Naval Material (CNM), are classified as an ACAT II program. In this case CNO is the decision authority in lieu of the DSARC, and a Navy Decision Coordinating Paper (NDCP) is required.

ACAT III programs are below the ACAT II level and have an estimated RDT&E cost in excess of \$5 million, or an estimated production cost in excess of \$20 million. Programs that directly and significantly affect the military characteristics of ships, aircraft, or other combatant units; that will require operational test and evaluation (OT&E) to support key program decisions; or that will require fleet RDT&E support are normally classified under this category. For these programs, the decision authority is the Program Sponsor.

ACAT IV programs are those not designated as ACAT I, II, or III. The decision authority is CNM or a designated subordinate. ACAT IV programs have similar documentation, management, and review as that of an ACAT III program.



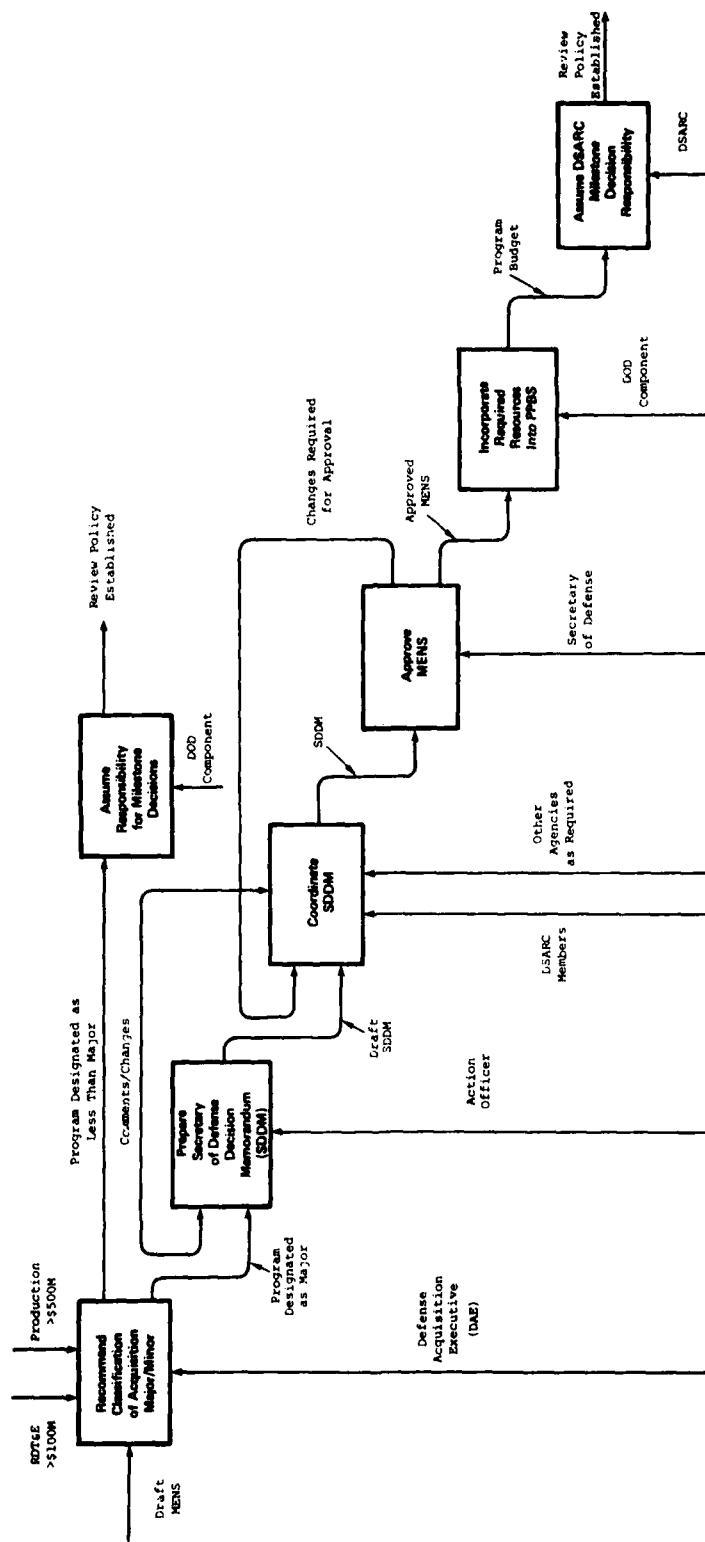
N-1I3 DETERMINE PROGRAM MILESTONE REVIEW
RESPONSIBILITY - DSARC MILESTONE 0

New acquisitions are identified in the yearly submission of the Program Objective Memoranda (POM). These submissions permit identification of those new acquisitions which are likely to exceed dollar thresholds, requiring preparation of a MENS. New system acquisitions exceeding the dollar thresholds that have not previously had a MENS reviewed and approved must have a MENS submitted to the Defense Acquisition Executive (DAE) no later than POM submission date.

The DN forwards a draft MENS with a recommendation as to whether the program should be designated as a "major system" to the DAE, who solicits comments from the OSD Staff, Office of the Joint Chiefs of Staff (OJCS), the other military departments, and the Defense Intelligence Agency. When the DAE plans to recommend designation as a major system, comments on the MENS are to be provided to the DN within 20 workdays from receipt of the draft MENS. Upon receipt of OSD comments, the MENS is revised and returned to the DAE within 20 workdays for approval action. When the DAE does not recommend designation as a major system, the MENS is returned to the appropriate functional organization, which assumes responsibility for milestone decisions on the program.

When the DAE plans to recommend approval of the MENS and designates a system as major, the action officer prepares a Secretary of Defense Decision Memorandum (SDDM) and forwards it to the SECDEF after formal coordination.

The SDDM also establishes the date for the Milestone I review. Upon approval of the MENS by an SDDM and designation of a system as major, necessary programming action is taken within the DN to incorporate required resources into the Planning, Programming, and Budgeting System (PPBS).

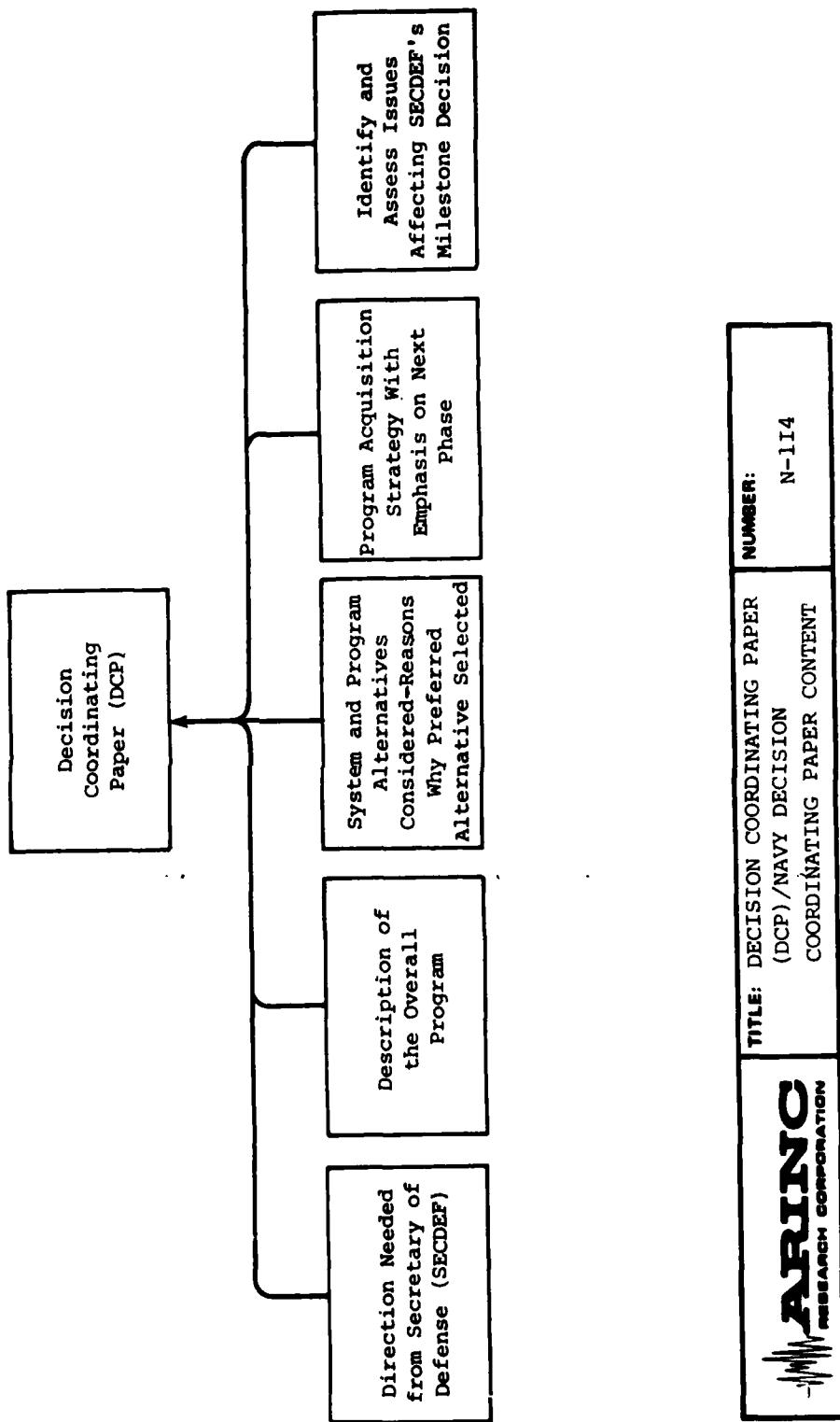


AIRINC RESEARCH CORPORATION	TITLE: DETERMINE PROGRAM MILESTONE REVIEW RESPONSIBILITY - DSARC MILESTONE Ø
	NUMBER: N-113

**N-1I4 DECISION COORDINATING PAPER (DCP) /Navy
DECISION COORDINATING PAPER (NDCP) CONTENT**

The principal purpose of the NDCP is to support the DSARC reviews and SECDEF decision-making for major programs (ACAT I) at Milestones I, II, and III decision points. The DCP is prepared for each major system program as a summary document of not more than 20 pages. Complete and timely preparation and processing of the DCP is critical to the review and decision-making and requires a continuing interface between the DN, the Defense Acquisition Executive, the Office of the Joint Chiefs of Staff, and the OSD staffs.

For less-than-major programs (ACATs III and IV), the purpose of the NDCP is to support, authorize, and promulgate the SECNAV/CNO decision to initiate development programs and establish appropriate advanced engineering development budget line items. Approved NDCPs authorize program starts and signal initiation of associated Operational Requirements and Development Proposals. The NDCP serves as the basis for preparing the DCP for ACAT I programs. NDCPs and DCPs have the same basic format.



ARINC RESEARCH CORPORATION	TITLE: DECISION COORDINATING PAPER (DCP) /NAVY DECISION COORDINATING PAPER CONTENT	NUMBER: N-114
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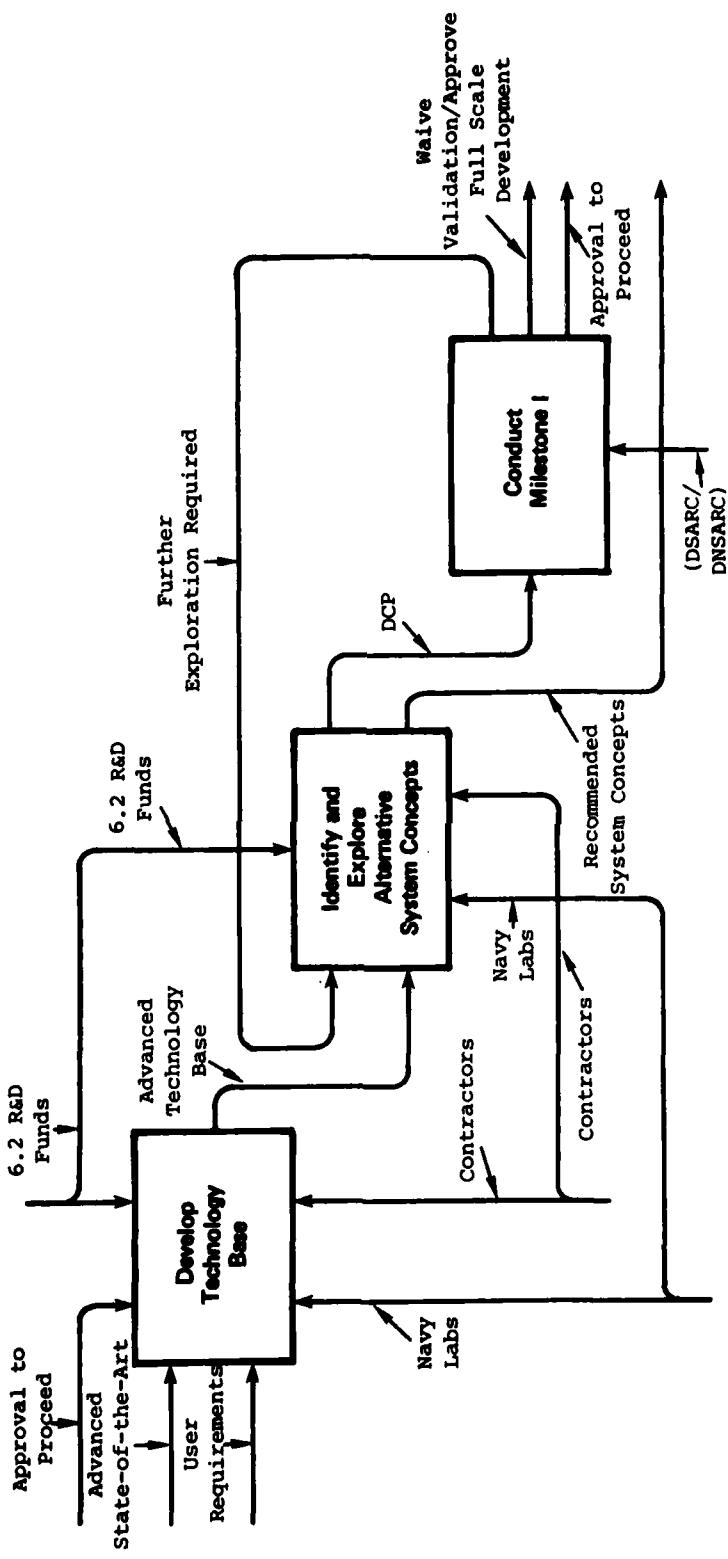
N-2 EXPLORE ALTERNATIVE SYSTEMS CONCEPTS

Exploratory development includes all efforts directed toward solving specific military problems, short of major development projects. This type of effort may vary from fundamental applied research to sophisticated breadboard hardware, study, programming, and planning efforts. The dominant characteristic of this category is that it is pointed toward specific military problem areas with a view toward developing and evaluating the feasibility and practicability of proposed solutions and determining their parameters.

Those areas of advanced state of the art recommended for exploratory development are investigated to develop a specific technology base. During this development, user requirements are evaluated and program characteristics, in terms of performance, cost, and schedule, are established through extensive study and analysis.

The SECDEF decision at Milestone 0 states the conditions for program initiation. The decision sets forth the basis for subsequent action to select options for demonstration and validation. The commitment in the exploratory development phase is limited to identifying and exploring alternative solutions or system concepts, with no commitment to any specific solution. When feasible, mission needs are satisfied with the use of existing military or commercial items. When the need can only be satisfied through modification or new development, the needs of other DoD components and NATO standardization, and interoperability requirements are to be considered. The task of exploring and identifying alternative system concepts is to emphasize competition to select the best possible solutions from industry, academic, and government sources, including foreign developments. As a result of the competitive identification and exploration of alternative design concepts, the demonstration and validation phase may (1) involve several alternatives, (2) be limited to a single system concept, (3) involve alternative subsystems only and not be conducted at the system level, or (4) there may be no demonstration and the program may proceed directly into full-scale engineering development. A DCP is prepared (see diagram N1I4) for the Milestone I decision, which recommends the preferred alternatives for demonstration and validation.

DSARC/DNSARC I reviews are generally conducted to consider the readiness to proceed with the program initiation (advanced development). Additional DSARC/DNSARC I-type reviews may be required to consider major changes in the need or threat, available technology, or budget requirements that could take place during the advanced development phase.



AERINC RESEARCH CORPORATION	TITLE: EXPLORE ALTERNATIVE SYSTEMS CONCEPTS	NUMBER: N-2
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N-3 VALIDATE AND DEMONSTRATE COMPETITIVE SYSTEMS CONCEPTS

Advanced development includes all projects that have moved into a hardware development phase for experimental or operational test. During this phase, program characteristics (performance, cost, and schedule) are validated and refined through extensive study and analysis, hardware development, or prototype testing. The quantity and level of prototype and hardware validation depend on the nature of the program and the risks and trade-offs involved. The overall objective of this phase is to determine whether to proceed with full-scale development. The goal, where development is to be performed by a contractor, is to establish firm and realistic performance specifications (allocated baseline) that meet the operational and support requirements.

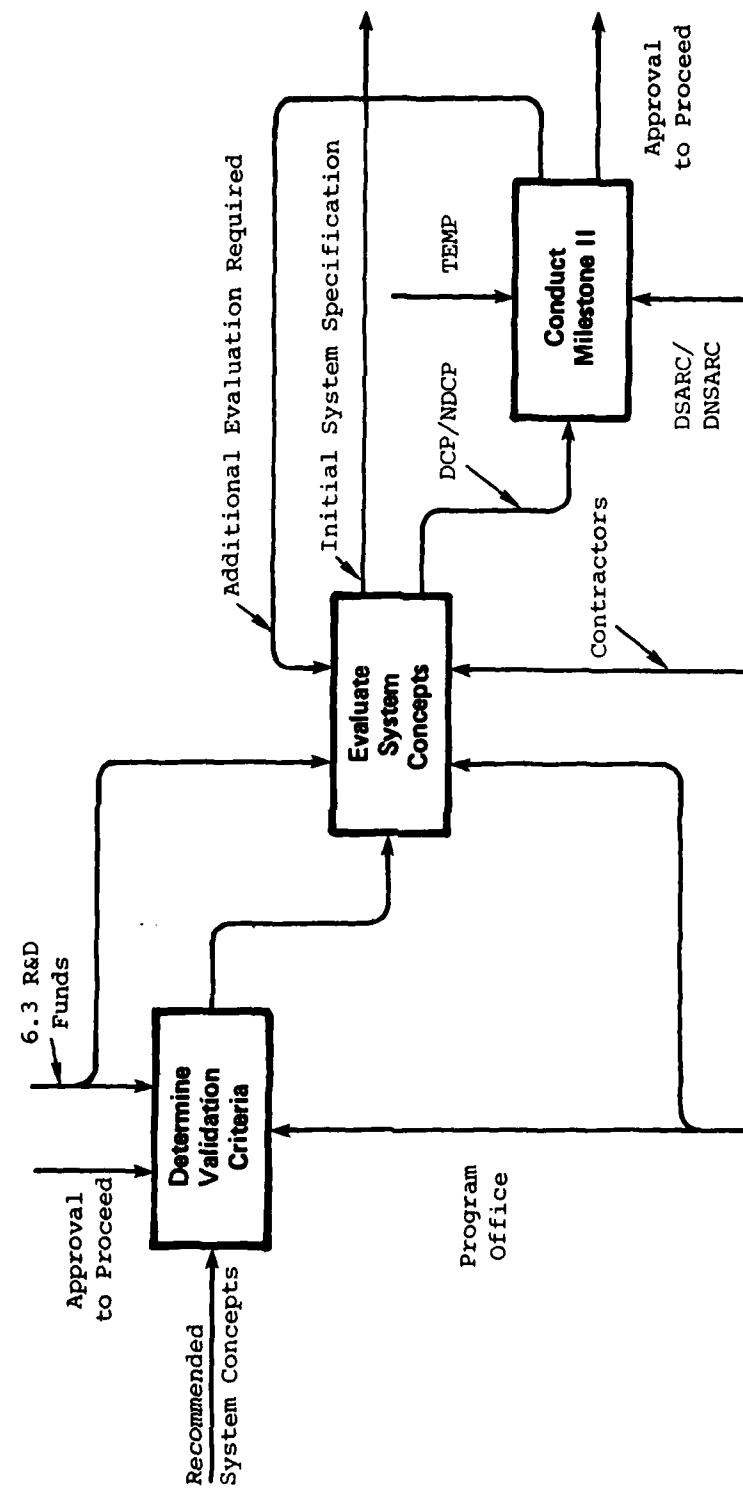
The Milestone I program decision to proceed authorizes the commitment of resources for advanced development. The program decision is forwarded to the DN with guidance, information, and the identification of required funds, consistent with the currently approved Five Year Defense Plan (FYDP). The SECNAV establishes or reaffirms priorities, issues guidance and direction, and forwards the necessary funding documentation to CNO and CNM. At this point, the principal Development Activity (DA) and Project Manager (PM)/Acquisition Manager (AM) (or other responsible official) are established and a Project Master Plan (PMP) is prepared.

Following the program-initiation decision, one of the first tasks of the PM/AM is to complete a Test and Evaluation Master Plan (TEMP) with the assistance of the Commander, Operational Test and Evaluation Force (COMOPTEVFOR). The purpose of the TEMP is to set forth all the T&E to be accomplished during the validation and subsequent phases. The TEMP addresses both developmental testing by the developing agency and Fleet operational testing by COMOPTEVFOR.

Upon delivery of a prototype system by a contractor, both Developmental Test and Evaluation (DT&E) and Initial Operational Test and Evaluation (IOT&E) are usually begun. These tests are designed to support the development activities in evolving a design that meets specifications and requirements and supports the program review and decision process.

DT&E is conducted under the sponsorship of the DA and is undertaken for the specific purpose of facilitating the evolution of the system. DT&E is conducted for the following purposes:

- To demonstrate that the engineering design and development process is complete



AFRINC RESEARCH CORPORATION	TITLE: VALIDATE AND DEMONSTRATE COMPETITIVE SYSTEMS CONCEPTS	NUMBER: N-3
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- To demonstrate that the design risks have been minimized
- To demonstrate that the system will meet specifications
- To estimate the system's military utility

DT&E includes testing of components, subsystems, and prototype or preproduction models of the entire system. Compatibility and interoperability with existing or planned equipment and systems are tested.

Upon completion of advanced development, the PM/AM updates the DCP to recommend the selection of a system for full-scale engineering development and production. The DCP/NDCP now addresses the total program through completion. The Milestone II decision is a commitment to continue the program through engineering development and includes approval for long-lead procurement items and such limited production as required to support the operational test and evaluation.

Operational Test and Evaluation (OT&E) is conducted by COMOPTEVFOR to estimate the prospective system's military utility, operational effectiveness, and operational suitability, as well as the need for any modifications. In addition, OT&E provides information on organization, personnel requirements, doctrine, and tactics.

IOT&E is often started during advanced development and completed during the full-scale engineering development. IOT&E is based on operational information obtained from DT&E, and the results are used to make a preliminary determination of operational effectiveness and suitability, including reliability, interoperability, compatibility, maintainability, and supportability.

The results of DT&E and IOT&E are used in preparing the updated DCP/NDCP to support a full-scale development decision.

N-3II PREPARE AND CONDUCT MILESTONES I, II, AND III REVIEWS

For ACAT I programs, planning meetings are scheduled by the DSARC Executive Secretary and chaired by the action officer six months in advance of each meeting. The purpose of the Milestone Planning Meeting is to identify the system and program alternatives and the issues and items to be emphasized in the DCP. DSARC members, advisors, DoD components, and the PM/AM are represented at the meeting.

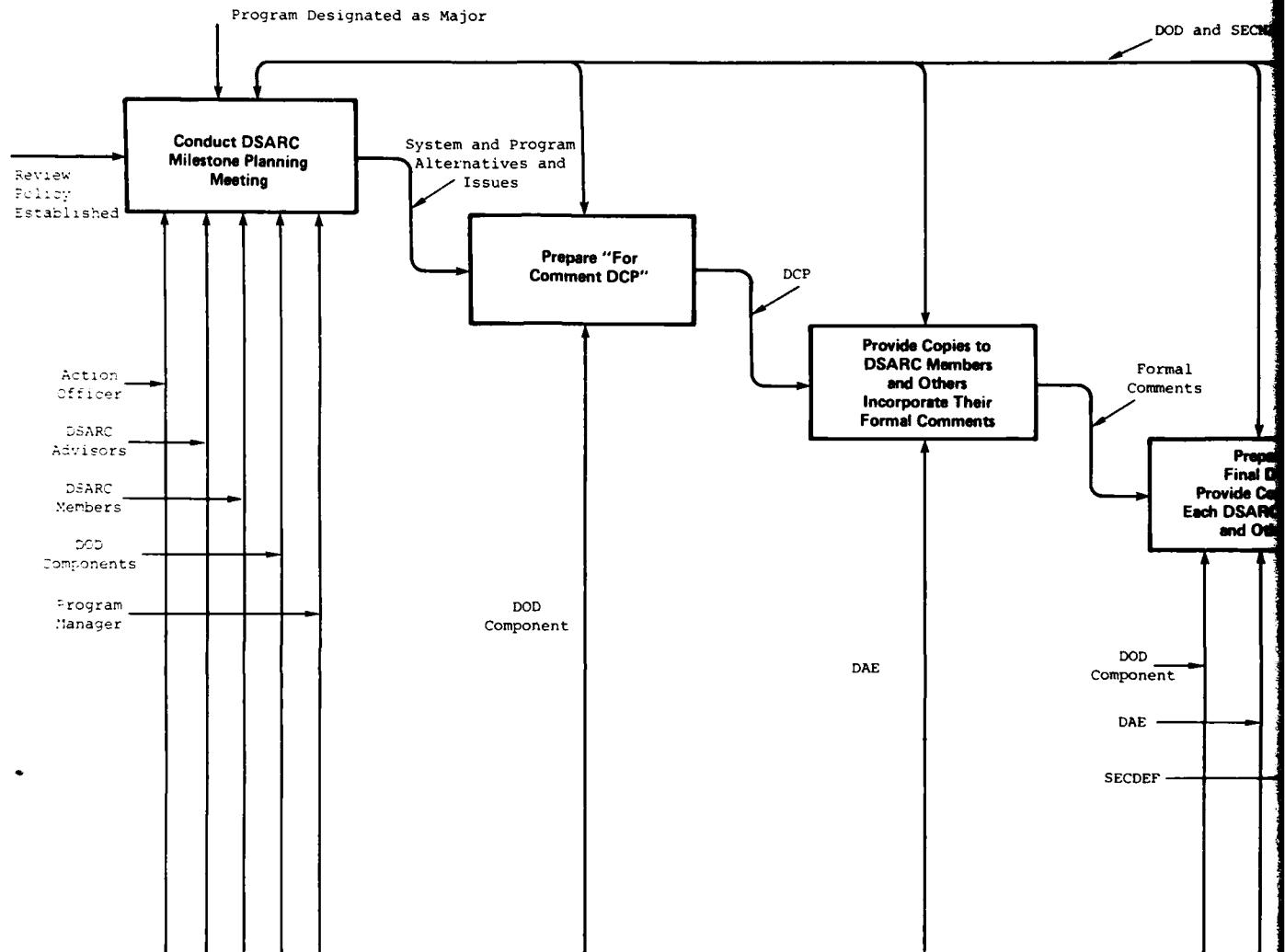
The "For Comment DCP" is submitted by the PM/AM to the DAE three months prior to a meeting. The action officer provides copies to members and advisors and to their staff for review and discussion. The action officer prepares and transmits formal comments to the PM/AM two months in advance of the scheduled meeting. Efforts are made to resolve major issues prior to the meeting, when possible.

A "Final DCP" is submitted by the PM/AM to the SECDEF through the DAE 15 workdays prior to a scheduled meeting. The action officer provides copies of the "Final DCP" to each member and advisor.

The position of each member and advisor on the DCP is determined by his staff representative to prepare for a presentation to be given to the DAE at the "Pre-Brief" meeting. Attendees at the "Pre-Brief" meeting discuss the DCP or provide specific program recommendations. Following this meeting, the action officer prepares a recommended position paper and provides copies to the members and principal advisors so that final action can be taken at the executive session after the formal DSARC meeting. Members and principal advisors present dissenting positions at the executive session for final resolution.

At the Milestone I review leading to the program initiation decision, the following is determined:

- A potential military need exists for a new Defense system or an improved system.
- The military requirements properly relate to the mission, the threat, and force obsolescence.
- Alternative defense systems that will satisfy the military need, including system modernizations and foreign developments, have been considered, together with anticipated resources for resolving the need.

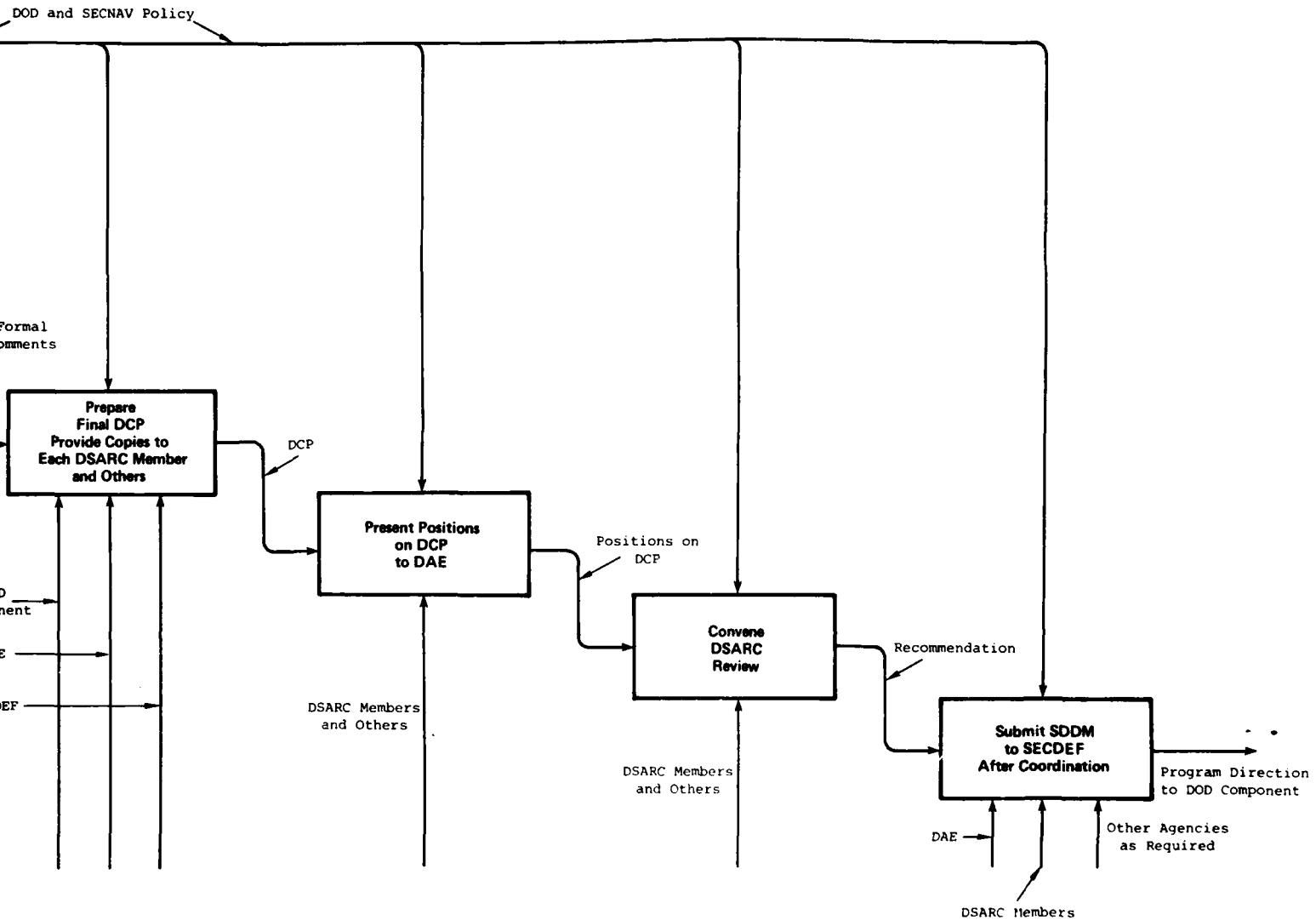


TITLE:

PREPARE AND CONDUCT MILESTONES I,
II, AND III REVIEWS

NUMBER:

N-311



- Broad mission/performance requirements/specifications are adequately defined (technically) and are economically plausible.
- Anticipated quantity, resource, and schedule estimates are realistic and acceptable in context with affordability limits. The appropriate acquisition (e.g., planning estimates) and ownership cost estimates have been validated by independent assessment.
- Major problems, issues, and risks are identified, and suitable methods for their resolution, such as the use of prototypes, are planned.
- The statements of questions and issues and of test objectives and schedules are adequate.
- Critical logistic support factors and facilities impact have been identified.
- Future support costs, including a comparison with those of current systems, have been considered.
- The use of currently available subsystems versus development of new subsystems, has been or will be considered.
- Economic and technical competition to the maximum extent feasible is planned.
- Program thresholds in the DCP are appropriate, well defined, and provide the flexibility for accomplishing trade-offs while ensuring timely identification of significant problems.
- Practical trade-offs have been made between performance risks, cost, and schedule.
- The acquisition strategy, including type of contract, is consistent with program characteristics and risk.
- Possible alternative fall-back positions are available in the event the proposed approach to the program is unsuccessful.
- Design-to-cost goals, related reliability and maintainability goals, and associated thresholds are established.
- Requisites for transition to full-scale engineering development have been established.
- The program plan for this acquisition is adequate.

The Milestone II decision considers the same items as above but is oriented toward the full-scale engineering development phase. In addition, it includes the following:

- An integrated test and evaluation plan has been prepared that identifies and integrates the effort and schedules of all T&E

to be accomplished and ensures that all necessary T&E is accomplished prior to the decision points.

- Requisites for the production/deployment decision, including logistics support, have been established.

Additional questions reviewed at the Milestone III decision are as follows:

- The acquisition strategy and contract plan are consistent with program characteristics and risks, and the approach to contractor selection is sound. The proposed contract type and options, if any, provide DoD flexibility for increasing or decreasing the production rate and total quantity.
- Requisites for future production decisions have been defined, and competition (e.g., second source and/or breakout) has been considered.
- The plan for transition to production and deployment is adequate, including integration with existing operational systems.

For ACAT I programs, Navy program reviews are first conducted by the CNO Executive Board (CEB) and DNSARC to determine the Navy's preferred alternative. ACAT I programs are then reviewed by DSARC, and program decisions are made by SECDEF. ACAT II programs are first reviewed within the Navy by the Acquisition Review Council (ARC); OP-090, acting for CNO, determines the Navy's preferred alternative. Those programs selected by a DSARC principal are then reviewed by DSARC or DoD management, and program decisions are made by the DSARC principal. Normally, ACAT II programs are reviewed by ARC and OP-090 (acting for CNO). CNO is the decision authority. ACAT III programs are reviewed by an OPNAV Review Board with membership designated by the Program Sponsor (DCNO/DMSO). Program decisions are made by the Program Sponsor acting for CNO. Reviews of ACAT IV programs are as directed by CNM, who is the program decision authority for ACAT IV programs.

N-4 DEVELOP ENGINEERING DEVELOPMENT MODELS

Full-scale engineering development encompasses (1) the design, fabrication, and testing of a preproduction system that closely approximates the final product, (2) the documentation necessary to initiate production; and (3) the testing necessary to show that requirements have been met. The essential activity is the test and evaluation conducted by the contractors and the DN. The Milestone II program decision authorizes the commitment of resources for full-scale engineering development of the detailed design of the system.

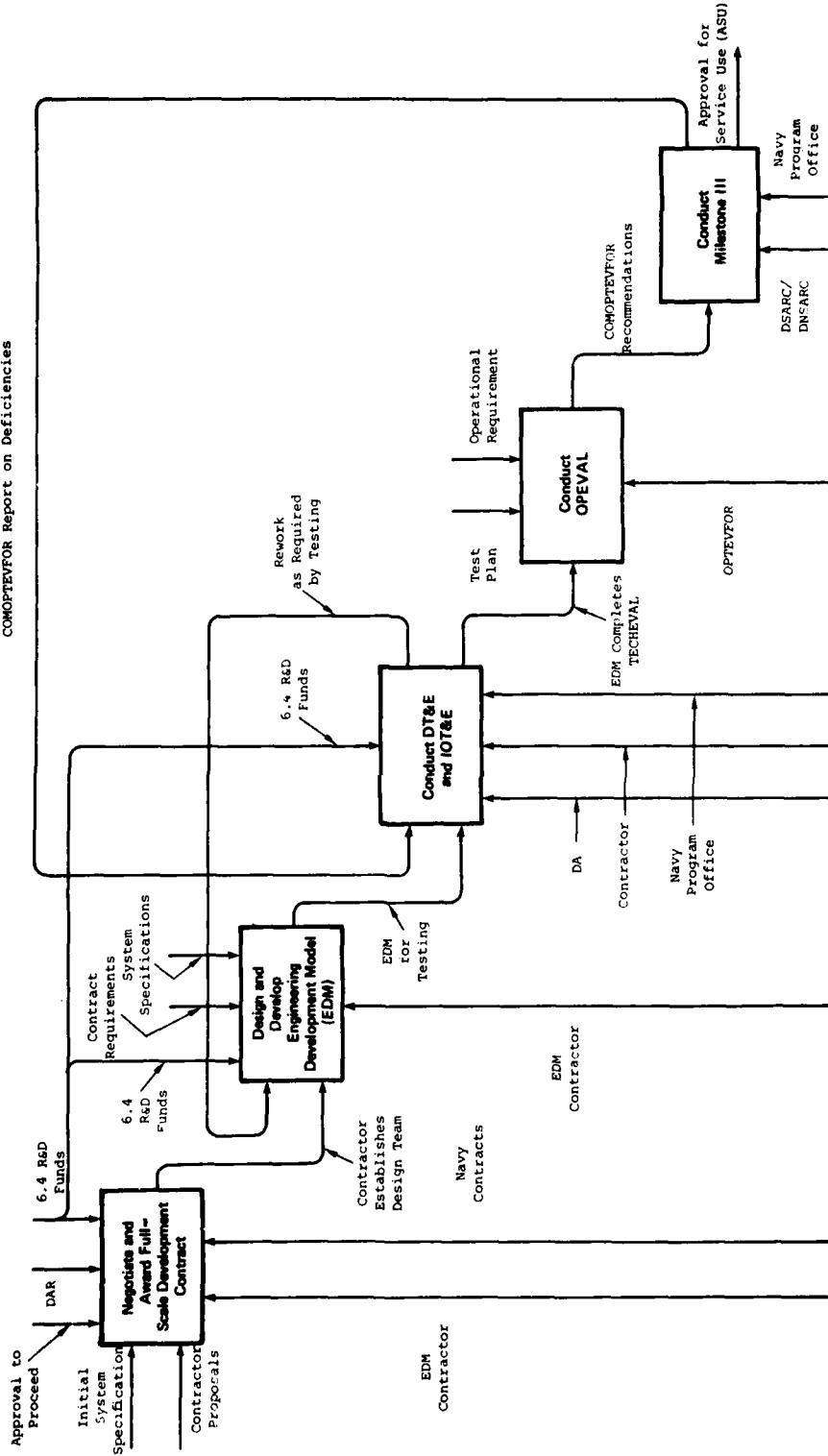
Typically, contractor final reports from advanced development include proposals for full-scale engineering development. The proposals are reviewed to eliminate redundant and unnecessary reports, documentation, and work tasks. Competition is usually sought throughout advanced development; however, beginning with full-scale engineering development, competition either is limited to two manufacturers or ceases completely.

On the basis of the procurement strategy, as documented in the Advance Procurement Plan (APP) and included in the approved DCP/DNCP, a full-scale engineering development contract is negotiated and awarded. A cost-type contract (cost plus fixed fee or cost plus incentive fee) is usually used since the major portion of the risk is assumed by the Navy. The source-selection procedures are completed prior to contract award and are in accordance with the DAR requirements.

Using the specifications and system engineering documentation previously developed, the contractor initiates his iterative design efforts. Detailed drawings are prepared for the fabrication of preproduction prototype subsystems and major assemblies. Emphasis is placed on interface requirements. The contractor's design and development efforts are closely linked to the PM's/AM's Configuration Management Plan and have an impact on his general Integrated Logistics Support (ILS) planning.

The development specifications are revised and updated, and product/process/material specifications are prepared. These specifications constitute the Product Configuration Identification (PCI) documentation that establishes the product baseline. The type and level of detail to be contained in the PCI are determined by the expected method of reprocurement, the requirement for configuration audits, and the requirement for logistics support of potentially repairable items.

The contractor's compliance with specifications and other contract requirements is verified by means of configuration audits. Two types of



4-31

audits -- the functional configuration audit and the physical configuration audit -- are performed, depend on the type of development. The configuration audits are usually performed in conjunction with other audits, program reviews, demonstration/service tests, inspections, acceptance trials, or other test and evaluation program requirements.

During full-scale engineering development, all items necessary for the logistics support of the system are designed, fabricated, and tested. Key inputs are the ILS work statements and clauses previously developed from the Integrated Logistics Support Plan (ILSP).

The ILSP is maintained through Production and Deployment and forms a part of the PMP and appropriate portions of other plans. It provides the foundation for coordinated action on the part of logistic element managers and the contractor, and documents the manner in which each of the applicable elements of ILS are to be obtained and integrated with the other elements throughout the life cycle.

The ILSP includes milestones, delivery points, names, and specific responsibilities of persons accountable for each element; basic guidance on the logistic system desired; relationships and interdependencies among the personnel; and the monitoring or communications system that will be used to exchange information among participants. Specific format and length of an ILSP vary with the complexity of the acquisition program. The ILSP is evolutionary in its development.

During full-scale engineering development, DT&E is continued to ensure that engineering is reasonably complete, that all significant design problems (including compatibility, interoperability, reliability, maintainability, and logistics considerations) have been identified, and that solutions to these problems are in hand. DT&E is accomplished through Technical Evaluation Projects (TECHEVAL) assigned by the CNO. A TECHEVAL consists of the investigation of systems or equipments and the collection of information that will assist in answering technical questions and issues. The purpose of this testing and analysis, conducted by or for the DA during the period of the TECHEVAL project, is to permit the DA to determine whether the system or equipment is functioning in a technically acceptable manner, meets design and technical performance specifications, and is technically suitable for Operational Evaluation (OPEVAL).

The DA has primary responsibility for planning the test program, including the coordinated operational inputs of COMOPTEVFOR. The TECHEVAL and OPEVAL are complementary test programs and complete IOT&E. Together, they produce data and address the spectrum of questions and issues to be considered prior to a major production decision. Accordingly, through close liaison, COMOPTEVFOR and the DA ensure that the test plans are mutually agreeable and integrated to the extent that they adequately address the critical questions and issues posed in the governing DCP or comparable document and provide for the maximum practical use of common test data.

Testing during the TECHEVAL may be conducted on production prototype or pilot-production models. Prior to an OPEVAL, the DA institutes a design freeze on the equipment or system and certifies it to CNO/COMOPTEVFOR as

ready for OPEVAL. The COMOPTEVFOR is responsible for arranging Fleet service required in the conduct of the project as requested by the DA. In addition, COMOPTEVFOR may observe such tests and is given free access to whatever data are considered necessary to permit evaluation of the operational aspects of the equipment or system. The DA submits a copy of all reports of test results to COMOPTEVFOR and certifies to CNO and COMOPTEVFOR that the equipment is ready for OPEVAL -- that is, that the following conditions are met:

- The system or equipment functions in an operationally satisfactory manner and performs reliably and effectively in accordance with program objectives in realistic operational conditions.
- The system can be effectively operated and maintained by personnel of the skill level expected to be available under service conditions.
- There is reasonable indication that logistics supportability in a deployed status is feasible.
- All test questions pertinent to a production decision are adequately examined.

Upon completion of the evaluation, COMOPTEVFOR submits a report to CNO, with a copy to DA, addressing each critical operational issue stated in the controlling program directives. The report presents the results of the evaluation and includes recommendations concerning operational effectiveness and suitability (including reliability, maintainability and supportability, training procedures, training aids, personnel requirements, and countermeasures) and basic procedures or tactics to be developed or employed for the equipment or system evaluated. The conclusion of an OPEVAL completes the IOT&E process.

All systems or equipments that are developed by the Navy or that the Navy intends to support must be "approved for service use" prior to commitment to major production. The "approval for service use" is that determination made by the CNO, or other delegated authority, on the basis of recommendations of the Service Approval Review Board (SARB) or the CEB, that the new system or equipment has undergone appropriate test and evaluation and has demonstrated the following:

- It will perform reliably, in accordance with design specification, in the intended or existing operational environment.
- It can be operated and maintained by personnel with the level of skill expected to be available under service conditions.
- It can be supported logically in a deployed status.

The total effort of the full-scale development phase is concluded with an update of the DCP in preparation for the production/deployment decision. This Milestone III decision constitutes SECDEF approval (or disapproval) to commit substantial resources to the production and deployment of a major defense system.

N-5 DEVELOP PRODUCTION MODELS

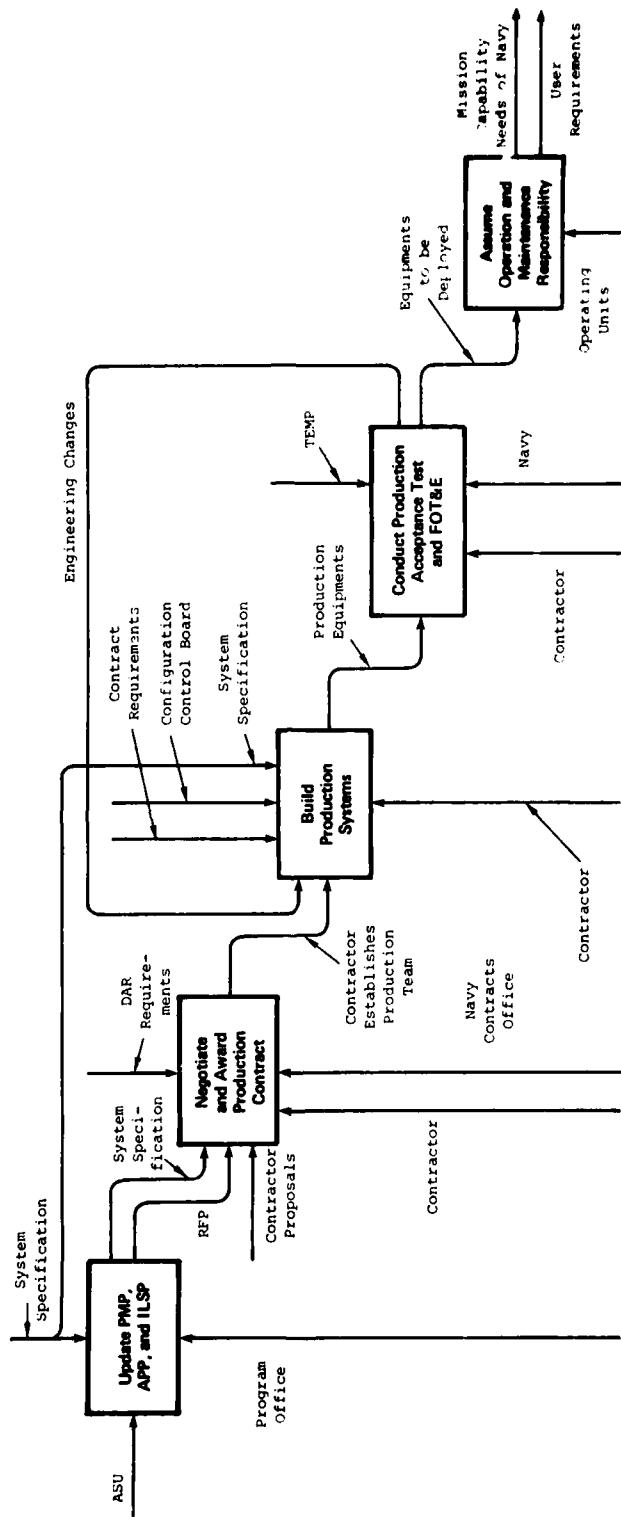
The Milestone III program decision is for the production of the system for operational use. On the basis of the procurement strategy, as documented in the APP and included in the approved DCP/NDCP, a production contract is usually negotiated and awarded to the full-scale engineering development contractor. A fixed-price contract, fixed price incentive successive targets, or firm fixed price is usually used since there is greater certainty associated with the program technical schedule and budget objectives at this point in the program. The risk shifts from the Navy to the contractor.

The production contractor is typically monitored during the production of the system and its support elements through Production Acceptance Test and Evaluation (PAT&E) by a contract administrative office. This office usually performs all assigned contract administration functions as requested by the purchasing office.

The contract administrative functions are often conducted by a Naval Plant Representative Office (NAVPRO) in the contractor's plant. The NAVPRO's functions include administration of the business aspects of the contract; logistics support, production, and R&D performance administration; quality assurance; provision, administration, and disposition of government property; engineering surveillance; and transportation management services. The full capability of PMs, SYSCOMs, NAVPROs, and the Defense Contract Audit Agency (DCAA) organizations are coordinated and employed to detect, define, and resolve cost, technical, and schedule problems. The objective of the contract administrative effort is to optimize the contractor's performance in keeping with the total overall objectives of the acquisition program.

Using the Logistics Support Plan Summary prepared for the production decision, the Integrated Logistics Support Manager (ILSM) finalizes a specific, detailed plan for each logistic element. These plans provide for two basic actions: supporting installation and checkout of the system and making each logistic support element available to support the operational phase. The ILSM assures that all the plans for all logistic elements are coordinated as an integrated whole for the specific system and that there are specific assignments of responsibility to carry out the plan.

At frequent intervals, the ILSM reviews the contractor's and Government's overall progress in meeting the requirements of the Integrated Logistics Support Plan and modifies or approves any section as appropriate in accordance with the contract. The ILSM develops a transition or turnover plan that indicates the point at which the functional organization



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will assume responsibility for logistics support of the system or equipment. The plan includes all the information necessary to assure an orderly changeover, as well as continuing and adequate logistics support.

Normally, concurrent with the delivery of the system or equipment from a production contractor, the system-oriented logistics support has been obtained and is functioning as a part of the total system. Communication is established with the operating units to determine the effectiveness of the initially provided logistics support. Once the system has been turned over to the operating unit, logistics support becomes the responsibility of the functional organization of the operating unit.

The foundation of the provisioning process is the procurement of Provisioning Technical Documentation (PTD) from the contractor, which is planned during full-scale engineering development and executed during system production. The PTD is to be used for identifying, selecting, and determining initial requirements and the cataloging of support items to be procured through the provisioning process.

DT&E and OT&E are continued, as necessary, to refine the system's military utility, operational effectiveness, and operational suitability and to determine need for any modifications. T&E is also conducted to evaluate changes and to reevaluate the system if a new environment or threat is imposed on the system. A key activity during production is PAT&E -- test and evaluation of production items to demonstrate that they meet the requirements and specifications of the procuring contract. PAT&E is usually conducted by field contract administrative offices of NAVPROOs.

Follow-On Test and Evaluation (FOT&E) is usually conducted following a favorable production decision to verify the performance of the new production unit; to validate correction of deficiencies previously identified; to further develop doctrine and tactics; and to complete the evaluation of the reliability, maintainability, and logistic supportability of the production system. FOT&E may also be used to examine or develop concepts and procedures to better define and determine requirements for further system development.

FOT&E is conducted in the Navy through the assignment of a Fleet Operational Appraisal project by the CNO. This project may be initiated by a recommendation submitted by COMOPTEVFOR on completion of an OPEVAL or by request of a Fleet Commander-in-Chief or type commander. The Fleet operational appraisal projects are assigned by CNO to COMOPTEVFOR or to other commands as recommended by COMOPTEVFOR. The designated command prepares the project plan, conducts the project, and reports the results. When not assigned primary responsibility for a Fleet operational appraisal, COMOPTEVFOR furnishes assistance in planning and data analysis as requested.

Deployment begins when the production items are provided to Navy operating units and these units accept property accountability and responsibility for the operation and maintenance of the first production units of the new system. No formal review or approval process is conducted between production and deployment.

CHAPTER FIVE

QUALITATIVE COMPARISONS OF NAVY AND COMMERCIAL ACQUISITION METHODOLOGIES

To determine the feasibility of implementing airline acquisition concepts in the Navy CSA Program, those elements of the Commercial Airline Acquisition Methodology which might be considered for adaptation to the CSA Program had to be identified and evaluated. A comparative analysis of the Navy acquisition methodology to the CAAM and U.S. Air Force avionics acquisition methodology was conducted for this purpose.

The comparative analysis presented in this chapter emphasizes the Navy and commercial airlines methodologies. The U.S. Air Force avionics acquisition methodology was compared in every case, but it is only mentioned in this chapter if that analysis supported either the commercial or Navy acquisition methodologies. This analysis addresses general characteristics (e.g., methodology phases, scope, requirements). Each area of comparison is addressed separately, with the key characteristics of the methodologies briefly described, followed by a discussion of the similarities and differences.

The following sections present a comparison of the Navy acquisition methodology with the CAAM and the U.S. Air Force avionics acquisition methodology. The comparison emphasizes those elements of the CAAM which have potential for incorporation or adaptation to the Navy CSA program. The conclusions and recommendations drawn from each area of comparison are presented in Chapter Six.

5.1 ACQUISITION PROGRAM PHASES

5.1.1 CAAM

In the CAAM no formal acquisition methodology has been established or promulgated in any specific document or reference. What has been described in Chapter Two represents the result of a 40-year evolutionary process within the airline industry. The various "phases" are defined to facilitate the description of a methodology that has been generalized across the industry. Therefore, the CAAM does not represent a formal structure but rather a general sequence of events common to the acquisition life cycle of avionics and electronic equipment. Most of the events are conducted at the option of the individual airlines.

5.1.2 U.S. Air Force Avionics Acquisition Methodology

The U.S. Air Force avionics acquisition methodology has been established to prescribe a specific acquisition policy. Like the CAAM, the methodology has been generalized so that no specific "phases" are addressed. The methodology has been formally referenced in AF Regulation 800-28, which describes a functional guidance process for the responsible management activities. Thus this acquisition methodology is a hybrid of the CAAM and DoD acquisition standards, resulting in a more flexible acquisition policy with supporting policy guidelines.

5.1.3 Navy Acquisition Methodology

The acquisition methodology, described in Chapter Four, projects the Department of the Navy (DN) acquisition policy. The DN acquisition methodology has evolved over approximately 30 years. A formal structure consisting of five phases is prescribed in a hierarchical series of instructions and directives by DoD and DN. For major weapon system acquisition and less-than-major programs, the phases are highly structured and consist of a required sequence of events. A highly formalized program review and appraisal process is prescribed, which consists of various committees, boards, and councils leading to the appropriate higher approval authority. Flexibility, however, is encouraged for those DN acquisitions which do not meet the criteria for major or less-than-major weapon system acquisitions.

5.1.4 Similarities and Differences

All methodologies represent a general sequence of events that normally occur; however, the DN process is more structured and formalized through a series of directives, instructions, and regulations. With the exception of the FAA Technical Standard Order (TSO) process within CAAM, the CAAM activities are performed at the option of the individual airlines, and their participation with other airlines in the activities of the AEEC and AMC is purely voluntary. In the Navy the program review and appraisal process is highly formalized and repetitive, while in CAAM the process is considerably more informal, with approvals by majority vote of the airlines as in the case of the AEEC/AMC activities. The remainder of the CAAM methodology is exercised solely within the approval authority exercised by the individual airlines.

5.2 SCOPE OF ACQUISITION PROGRAM

5.2.1 CAAM

The CAAM describes the general sequence of events that typically occur during the airlines industry acquisition of avionics and aircraft electronic equipment.

5.2.2 U.S. Air Force Avionics Acquisition Methodology

The U.S. Air Force avionics acquisition Methodology describes the policy and responsibility for acquiring and supporting avionics components,

equipment, and systems. The methodology emphasizes the acquisition of avionics that are equivalent to DN ACAT III and IV.

5.2.3 Navy Acquisition Methodology

The DN acquisition methodology describes the required activities and program documentation of a hierarchy of acquisition programs, ranging from the most complex (major weapon systems) to the simplest (individual equipments).

5.2.4 Similarities and Differences

The CAAM is similar in scope to the U.S. Air Force avionics acquisition methodology and the simpler DN acquisition programs, specifically those managed within the various SYSCOMs. DN major and less-than-major weapon system acquisition programs cannot be equated to the scope of the CAAM; however, selected subsystem acquisitions within these programs could be equivalent. The CAAM is intended for the acquisition of equipment that meets selected criteria, while the DN acquisition methodology represents a hierarchy of systems and equipment.

5.3 COMPETITION

5.3.1 CAAM

The CAAM utilizes and encourages competition throughout the life cycle. Competition affects not only price but also performance and delivery as long as the equipment continues to be utilized.

5.3.2 Navy Acquisition Methodology

A basic Nav. policy is to promote free and full competition. However, competition within the DN most often ceases upon contract award. Life-cycle competition as employed in the CAAM is receiving increased attention in the DoD and Navy. Little effort has been made to maintain competition during the deployment, operation, and maintenance of equipment unless data rights are purchased for subsequent production lots.

5.3.3 Similarities and Differences

Both methodologies encourage and employ competition. The forces of competition are applied throughout the life cycle of the equipment under the CAAM. The U.S. Air Force is moving in the direction of life-cycle emphasis on avionics with the implementation of the avionics acquisition methodology. In the Navy, competition is essentially removed following contract award. Competition following award of the initial production contract is retained in the airline community by each user making a series of small unit purchases rather than a single large purchase. The CAAM provides for many independent users, procurements, and suppliers. In contrast, the DN methodology typically involves one user, one large-scale procurement, and limited suppliers.

Competition is also maintained during the Operational and Maintenance (O&M) phase of the CAAM through open-forum meetings and publications of

the AMC. Through public discussion of maintenance problems and monthly documentation of the performance in terms of the top-ten unscheduled removal summaries, various manufacturer's equipments are subjected to public critique. This, in turn, motivates the various suppliers to correct design deficiencies and improve their equipment's reliability, maintainability, and availability, often at no cost to the airlines.

5.4 RESEARCH, DEVELOPMENT, TEST, AND EVALUATION (RDT&E)

5.4.1 CAAM

RDT&E is rarely funded or conducted by the individual airlines under the CAAM. System requirements studies are conducted by the RTCA, and logistics improvement studies are performed by ATA through the voluntary efforts of its participating organizations. These efforts frequently contribute to the CAAM through the study of future system requirements, the provision of information to ARINC Characteristics, the establishment of Minimum Performance Standards (MPS), and the creation of standard logistics practices. Limited test and evaluation is performed by the airlines in their source-selection process for new avionics and electronic equipment acquisitions. This T&E usually consists of a laboratory demonstration test of a vendor's product that is typically offered at no expense to the airlines. Occasionally, flight tests of the new avionics are conducted in conjunction with the avionics manufacturer or airframe manufacturer; however, this is a considerably more complicated and expensive procedure and involves FAA approval. The airlines rarely conduct environmental tests, because these tests are performed by the respective manufacturers through the TSO certification process.

5.4.2 U.S. Air Force Avionics Acquisition Methodology

The U.S. Air Force avionics acquisition methodology states that testing standards will be applied during the development and evaluation test cycles. In the case of the F³ INS, the Air Force has encouraged industry to provide equipment built to the F³ specifications as well as to provide accompanying test data. The methodology still imposes Development Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E), and the Air Force Test and Evaluation Center is primarily responsible for these activities. The Air Force emphasizes internal test and evaluation funded with Government funds. The funding of R&D efforts for the specific avionics is assumed to be borne by industry as a competitive "price of admission". This aspect of the Air Force RDT&E most closely resembles that of the CAAM.

5.4.3 Navy Acquisition Methodology

The Navy conducts extensive RDT&E throughout the life cycle of the acquisition process. Research and development is a continuing activity that supports both the PPBS and DN acquisition process. It is a key contributor to the concept, validation, and full-scale development phases. DT&E, OT&E, and PAT&E are conducted in the various phases essentially at the expense of the Navy. DT&E is planned, conducted, and monitored by the DN developing agency; OT&E is usually conducted by COMOPTEVFOR, the Navy's independent test agency. PAT&E is conducted by DN field administrative offices (NAVPROs) throughout the production phase of the acquisition process.

DT&E is conducted to demonstrate (1) that the engineering design and development process is complete, (2) that the design risks have been minimized, and (3) that the system will meet specification, as well as to estimate the system's military utility.

OT&E is conducted to estimate the prospective system's military utility, operational effectiveness, and operational suitability, including compatibility, interoperability, reliability, maintainability, and logistics and training requirements. In addition, OT&E provides information on organization, personnel requirements, doctrine, and tactics. OT&E typically consists of IOT&E and OPEVAL.

PAT&E is the test and evaluation of production items to demonstrate that the items procured fulfill the requirements and specifications of the procuring contract or agreements.

The T&E Master Plan (TEMP) is prepared before the full-scale development phase is initiated to identify and integrate the effort and schedules of all T&E and to ensure that all necessary T&E is accomplished prior to the key decision points.

5.4.4 Similarities and Differences

All methodologies recognize the importance of RDT&E; however, the CAAM rarely funds or performs R&D. The CAAM takes advantage of the R&D efforts of the DoD and avionics vendors. The Air Force has attempted to benefit from this area of the acquisition process. A majority of Navy R&D is planned and funded by the Navy and conducted jointly with other DoD agencies and industry.

The airlines perform essentially a limited T&E, while the Navy typically performs extensive DT&E, OT&E, and PAT&E. The airlines' T&E is typically a laboratory evaluation of new avionics products as a part of their source-selection process and can be equated to a limited Navy OPEVAL. The airlines rarely conduct DT&E and never conduct PAT&E, as in the Navy. PAT&E is not required in the CAAM because the airlines are essentially purchasing off-the-shelf avionics equipment and allow the forces of competition to ensure quality production and acceptance testing. Avionics vendors perform T&E at their own expense to meet the minimum performance standards of TSO certification.

Neither R&D nor T&E plans are prepared or required by the airlines in the CAAM, while both are necessary in the DN process and the USAF, to a lesser degree.

5.5 SOURCE-SELECTION CRITERIA

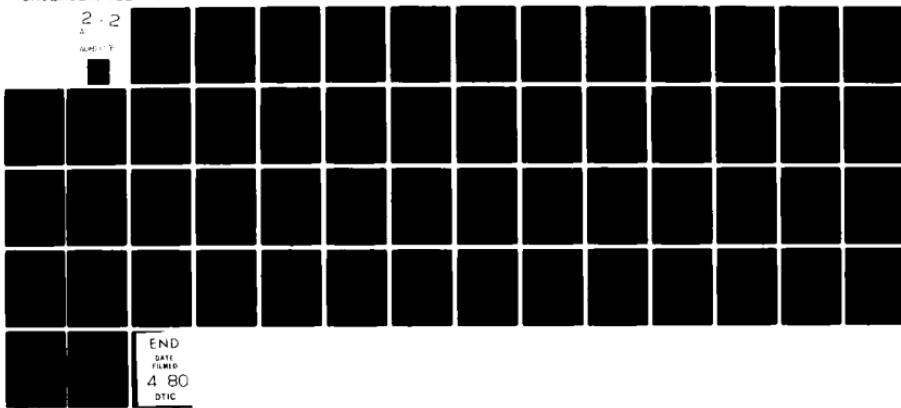
5.5.1 CAAM

The airlines are equally concerned with a prospective vendor's past performance and the proposed avionic equipment performance and product support (i.e., warranty). The supplier is selected in a simple manner

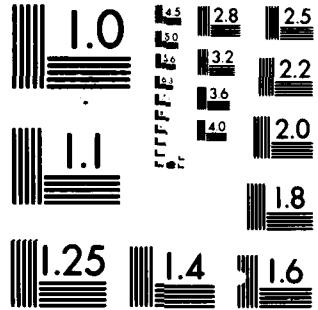
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since the equipment has usually been built to an ARINC Characteristic and the aircraft is prewired for the equipment. Most vendors attempt to establish a favored position with a particular airline through personal relationships and demonstrated performance as an indication of commitment.

5.5.2 Navy Acquisition Methodology

The DN source selection consists of technical and managerial criteria and the proposed price. Each of these factors are evaluated in a complex manner by an independently constituted source-selection board. The source-selection decision is rendered by an appropriate source-selection authority, who is usually at least one echelon above the program manager.

5.5.3 Similarities and Differences

Both methodologies use technical, managerial, and cost criteria in the evaluation of competing suppliers. The airlines are most concerned with a vendor's past performance, including warranty services, with that airline, while the Navy's evaluation centers on a competing vendor's proposal. The CAAM does not require the preparation of complex, often costly manufacturer proposals nor is the CAAM concerned with the manufacturer's management plan for the design and production of the intended equipment, as is the Navy. The Navy tends to award the contract on the basis of the lowest bid, provided that the technical and managerial aspects are acceptable. The Navy usually cannot legally consider a proposed manufacturer's previous contract performance.

5.6 PROCUREMENT COST

5.6.1 CAAM

Each individual airline negotiates a final price with the vendor of his choice. This final price for avionic equipment typically includes a three-year warranty and necessary initial support. Substantial competitive discounts are typically accorded airlines by manufacturers, which could reduce advertised "list prices" by as much as 50 percent. The final negotiated price may be influenced by other considerations, such as modification to other equipment that the supplier has furnished or "trade-in" allowances on a competitor's equipment that is being replaced. The airlines usually expect that the equipment will be furnished with operating, maintenance, overhaul, and parts manuals prepared in accordance with ATA Specification 100, service bulletins and revisions, and a reasonable amount of training at no additional cost.

5.6.2 Navy Acquisition Methodology

The Department of the Navy, acting as a consolidated buyer for all Navy users, typically negotiates a final price that includes necessary initial provisioning to support organic maintenance. Each initial support requirement (e.g., technical manuals) is typically delineated and costed separately from the equipment. Only off-the-shelf equipment procurements include manufacturer's standard support in the unit price, which usually

includes a maintenance manual prepared to the vendor's specification and his "standard" warranty against defects in materials and workmanship.

5.6.3 Similarities and Differences

Both methodologies include negotiation with vendors to achieve the lowest price. The airlines negotiated price for avionic equipment typically includes, as a minimum, the unit price of the item and a three-year warranty. Also included in the unit price is the cost of initial support; i.e., the airlines expect the vendors to provide technical documentation (e.g., technical manuals and spare parts lists) and training at no additional cost. The Air Force is attempting to include similar types of agreements. The Navy, in contrast, typically awards the contract to the lowest bidder on the basis of his best and final offer and usually purchases initial provisioning, technical documentation, and training at a negotiated price over and above the unit price. Only DN off-the-shelf procurements for commercial products (e.g., test equipment) resemble the airline procurement environment. Competitive discounts are occasionally accorded the Navy; however, "trade-in" allowances are essentially nonexistent.

5.7 PROCUREMENT PACKAGE

5.7.1 CAAM

The typical CAAM procurement package consists primarily of logistics support considerations relating to warranty administration; reliability guarantees; manuals; data and technical assistance; spare parts, service, and training; and product support. The ARINC Characteristic or a product specification is typically not required in the procurement package, because the airlines are essentially purchasing off-the-shelf equipment. Therefore, a typical procurement package contains only essential support details and usually consists of only a few pages.

5.7.2 Navy Acquisition Methodology

The typical procurement package used in the DN acquisition methodology consists of a statement of work, detailed product specification, and data requirements listing. Each is a key element since the Navy is contracting not only for the equipment they want to purchase but, equally important, how the equipment is to be built. A typical procurement package is highly structured by various regulations and usually consists of several pages.

5.7.3 Similarities and Differences

Both methodologies use a procurement package that delineates the equipment desired, the necessary data requirements, and the delivery schedule. The CAAM procurement contract is concerned primarily with specifying logistics support requirements to include warranty. In contrast, the DN procurement contract is a complex package that specifies not only what the supplier has to do but also how the supplier is to perform.

5.8 EQUIPMENT DEVELOPMENT

5.8.1 CAAM

In the CAAM, various suppliers develop their avionic equipment at their own expense in anticipation of sales. The equipment is usually developed concurrently with the development of the ARINC Characteristic and conforms to at least the majority desires of the airlines as expressed in the Characteristic.

5.8.2 U.S. Air Force Avionics Acquisition Methodology

In the U.S. Air Force avionics acquisition methodology, vendors of F³ equipment are encouraged to develop the avionics at their own expense. This process varies depending on the degree of existing technology available. Like the CAAM, industry is encouraged to build the equipment to the prescribed F³ specification. The Air Force will fund differing degrees of development costs, depending on program priorities and industry capability.

5.8.3 Navy Acquisition Methodology

In the DN acquisition methodology, a single manufacturer is typically awarded a contract to develop the equipment in accordance with a specification. The equipment is designed at Navy expense and, typically, no latitude is permitted in the development and fabrication processes. A manufacturer may develop equipment at his own expense (IR&D), or at reduced cost, if a substantial commercial market also exists. The Navy also employs equipment that is developed primarily for the commercial market (e.g., general-purpose test equipment).

5.8.4 Similarities and Differences

All methodologies use equipment that has been developed at the manufacturer's expense. However, the CAAM achieves this saving for most avionic and electronic equipment, while the Navy typically must expend funds for most equipment developments, including avionic equipment. The Air Force is realizing development cost savings but not at the same scale as CAAM. The CAAM and the Air Force, through the specification open-forum development process, allows industry to express its desires for avionic and electronic equipment. No similar process is emphasized in the Navy, since the Navy must express its desires by invoking a specification. Even equipment developed at commercial expense must be typically modified at Navy expense to meet Navy needs.

5.9 LOGISTICS SUPPORT/WARRANTY

5.9.1 CAAM

The airlines typically possess three levels of maintenance: line, intermediate, and main base. The bulk of the maintenance is performed at the main base, which includes depot and overhaul activities. Most airlines have only one main base. Maintenance at line and intermediate points is essentially limited to a remove-and-replace repair philosophy

for avionics. The removed unit is normally returned to the main base for repair. Since the unit is typically under warranty, the main base will verify the failure and either return the unit to the manufacturer for repair or repair the unit in-house on a cost-reimbursement basis. Warranty, typically lasting up to three years, is procured for most avionics by the airlines. The cost of the warranty is usually included in the basic price of the avionics and is not priced separately. The warranty is administered in accordance with specific contract provisions and could include MTBF guarantees.

5.9.2 Navy Acquisition Methodology

The Navy has three levels of maintenance: organizational, intermediate, and depot. While some maintenance is performed at all levels, the majority of repair for shipboard equipment is performed at the organizational level. Intermediate maintenance is typically performed by tenders or Shore Intermediate Maintenance Activities (SIMAs). Limited use of depot maintenance facilities is required for the repair of avionics and other shipboard electronic equipment.

The Navy has made only limited use of warranty. Although increasing emphasis has been placed on the use of such techniques as Reliability Improvement Warranty (RIW) for various equipments, the potential exists for greater use of warranty for Navy equipments.

5.9.3 Similarities and Differences

Both methodologies possess three levels of maintenance that are similar in scope and activities. The methodologies differ in that each airline typically concentrates its repair facilities and activities at one main base, while the Navy performs most of its repairs at the organizational level.

The airlines make extensive use of warranty for several years and would not consider the purchase of complex avionics without a warranty. In contrast, the Navy is just beginning to make use of warranties. Both methodologies have had successful results in terms of increased reliability through the application of warranty.

5.10 CONFIGURATION MANAGEMENT AND STANDARDIZATION

5.10.1 CAAM

The ARINC Characteristic strictly controls the configuration of avionics in terms of form, fit, and function. The purpose of that configuration management and standardization program is to ensure the interchangeability of avionics regardless of the manufacturer. Therefore, the interface between the avionic "black box" and the airframe is paramount, while the internal design is left to the manufacturer. Engineering changes that would improve the reliability, maintainability, or availability are expected and encouraged by the airlines. These changes are an integral part of the warranty coverage and enable the manufacturer and the airlines to achieve mutual benefits within the warranty provisions and guarantees. The airlines expect the manufacturers to document their equipment (configuration and identification) through a series of technical manuals and

subsequent revisions in accordance with ATA Specification 100 at no additional cost to the airlines.

5.10.2 U.S. Air Force Avionics Acquisition Methodology

The Air Force has sought to control the interface configuration of avionics in similar terms of form, fit, and function through use of F specifications, where applicable. They serve to control the interface configuration similar to those found in the airlines use of ARINC Characteristics. If warranty coverages are negotiated, then the Air Force configuration management and standardization would closely resemble all aspects of the CAAM. Should final negotiations stress only production and initial delivery support, then the Air Force would be expected to implement configuration control down to piece-parts identification in order to provide life-cycle support.

5.10.3 Navy Acquisition Methodology

The Navy progressively applies more detailed configuration management as the acquisition program proceeds through the successive phases of the system life cycle. Three baselines (functional, allocated, and product) are progressively established, together with the necessary configuration identification documentation (technical documentation). The product baseline must be established prior to the production phase of the acquisition life cycle. This baseline is typically established only after functional and physical configuration audits have been performed. The associated Product Configuration Identification is typically expressed in the form of production specifications, which are used to prescribe necessary "build to" requirements or form, fit, and function requirements and the acceptance tests for these requirements. Documentation for the PCI is usually in accordance with various military standards. The purpose of the DN configuration management and standardization program is to control the configuration of production items down to and including piece parts.

Configuration control is actively maintained throughout the production phase through Engineering Change Proposals (ECPs). The ECPs are limited to those which are necessary or offer significant benefit to the Government. The ECPs are usually performed at an additional cost to the Navy, on the basis of a contractor's pricing of his ECP.

5.10.4 Similarities and Differences

All methodologies endorse configuration management and standardization, but to a different degree and for a different purpose. In the CAAM, the purpose of configuration management is to ensure interchangeability of like avionics. The configuration of the item is expressed through form, fit, and function requirements in ARINC Characteristics; no control is exercised on the internal design of the item. In contrast, the purpose of the DN configuration management program is progressively to control the configuration of the item through the system life cycle. The final configuration is typically expressed through "build to" specifications that control all aspects of the item, including parts, materials, and processes. The Air Force leans more toward the CAAM, but many aspects of the

Navy's configuration control could be expected, depending on final contract negotiations.

All methodologies encourage engineering changes; however, they are administered and costed differently. In the CAAM, engineering changes are usually researched and conducted at no additional cost to the airlines and are administered under existing warranty provisions. There is no requirement for airline approval of engineering changes, as long as they do not affect the form, fit, or function. In the Navy methodology, ECPs are usually performed at a cost to the Navy and are strictly administered by contract modification and prescribed procedures. Formal approval must be granted by the Navy before ECPs can be performed.

5.11 SUMMARY

The general program comparisons that have been presented in this chapter are summarized in Table 5-1. This table lists the areas of comparison and their key similarities and differences.

Contractor selection and negotiation is an area of significant difference between the military and commercial processes. For a military purchase (which uses public funds), vendor selection is a matter of extensive and rigid procedures. The Defense Acquisition Regulations and DoD and Navy regulations and guidance documents represent a complexity of procedures through which each procurement must be carried. Unfortunately, in spite of all the protective measures, satisfactory equipment performance is not assured by this process. A supplier with a performance record that is marginally acceptable can respond to various requirements repeatedly and can be afforded an opportunity for selection as the lowest-priced offeror; where such an offeror negotiates successfully, the user is denied the benefit of a better-qualified supplier.

In addition, the serious implications of awarding a large single contract has its effects on the procurement process. In recent years, decreasing military buying power led to consolidation of procurements to enlarge the purchase quantities. The award of "winner take all" contracts can mean bankruptcy or abandonment of the market for some losers -- losers who are not necessarily technically incompetent or economically unacceptable. As a result, the award decisions are frequently protested, and companies apply political pressure for reconsideration through their congressional representatives. Therefore, many pressures are applied to the contracting groups to document and justify the selection process carefully so that the decision is not vulnerable.

In contrast to military procedures, the CAAM requires each potential supplier to pay the "price of admission" by adapting his product to the market with his own money. The supplier then presents the product (rather than a promise of a product) for consideration by the buyers. By providing a sufficiently attractive product, the new supplier can recover his investment through competition with the established vendors and capture a part of their market.

Considering the presence of continually large military markets, it is reasonable to expect that manufacturers will be willing to follow the

No formal structure; only general sequence of events.	Formal acquisition policy.
The CAAM describes the acquisition of avionics and electronic equipment by the airline industry.	Describes the acquisition of avionics equipment for USAF below DSARC thresholds.
Life-span competition; exists at all times.	Life-span competition exists.
Airlines typically negotiate a final price that includes warranty and necessary initial support.	USAF initiating contract negotiations to include warranty and necessary initial support.
Certification required by TSO. Little R&D sponsored by airlines. Limited in-house T&E of loaned manufacturer's equipment.	USAF reducing planned & sponsored RDT&E. Some quality and acceptance tests still required.
Consists primarily of logistic support contract items. ARINC Characteristic is not usually part of contract.	Consists of F ³ specification, statement of work and other varied requirements as negotiated.
The airlines are equally concerned with equipment and supplier performance. Satisfaction with past supplier performance is a major selection factor.	USAF typically evaluates the technical, managerial, and cost aspects of the solicited proposals. Cost and product performance are usually the major selection factors.
Manufacturers typically develop equipment at own expense in anticipation of sales to airlines while Characteristic is being written.	Manufacturers typically develop equipment at own expense during or after specification development/promulgation.
Three levels of maintenance (line, intermediate, depot). Bulk of repair at depot. Extensive use of warranty supported repair.	Increasing use of warranty/contractor supported repair.

E 5-1 PROGRAM COMPARISONS

ACAT I & II ACQUISITION METHODOLOGY	ACAT III & IV DN ACQUISITION METHODOLOGY	SIMILARITIES	DIFFERENCES
Typically consists of five distinct phases for major item acquisitions. These phases are highly structured and consist of a required sequence of events.	Typically consists of five less formally structured phases.	A general sequence of events is normally followed in all processes. ACAT III & IV are similar to CAAM & USAF.	CAAM process does not include formalized phases. ACAT I & II most formalized of all.
Process is described for acquisition programs where RDT&E >20M/Production >50M	DN process is described for acquisition programs where RDT&E <20M Production <50M	The scope of CAAM is similar to that of DN ACAT III & IV.	The scope of the CAAM cannot be equated to major or less-than-major acquisition programs of the DN (ACAT I & II).
Competition used on a limited basis for development and solicitations for proposals. Essentially ceases to exist after production contract award.	Competition used on a limited basis for development and solicitations for proposals. Essentially ceases to exist after production contract award.	Competition is used to limit equipment purchase cost.	CAAM exploits competition throughout the life cycle. DN essentially limits most procurements to single source.
Typically negotiates a final price that includes necessary logistics support for organic maintenance.	DN typically negotiates a final price that includes necessary logistics support for organic maintenance.	All methodologies negotiate to achieve lowest cost.	Suppliers to airlines typically include warranty in their cost quotations.
Extensive RDT&E planned and sponsored by DN. Rigorous quality and acceptance tests.	Extensive RDT&E planned and sponsored by DN. Rigorous quality and acceptance tests.	All processes perform some quality and acceptance tests.	CAAM does not require extensive R&D or T&E; uses state-of-the-art techniques. Testing is limited to proof of performance.
Typically consists of: equipment specification, statement of work, data requirements. Method is highly structured by DARS.	Typically consists of: (1) equipment specification (2) statement of work (3) data requirements. Method is highly structured by DARS.	All procurement packages have various contract items, including requirements imposed by procurement regulations, data requirements, and schedule.	DN prepares a complex procurement package often constrained by DARS and program documentation requirements.
Typically evaluates the technical, managerial, and cost aspects of the solicited proposals. Lowest cost is usually the major selection factor.	DN typically evaluates the technical, managerial, and cost aspects of the solicited proposals. Lowest cost is usually the major selection factor.	All methodologies evaluate prospective offeror's cost.	CAAM and USAF are concerned with the supplier performance, to specification prior to negotiation. CAAM process does not solicit formal proposals and is not concerned with a management plan.
Manufacturers typically develop equipment only after contract award unless equipment has commercial application.	Manufacturers may develop equipment requiring nominal investment.	All processes involve varying amounts of manufacturer investment.	Most equipment designed and developed at manufacturer expense under CAAM.
Three levels of maintenance (organizational, intermediate, depot). Repair is performed at all three levels; bulk of repair for shipboard equipment performed at organizational level. Limited use of outside repair sources.	Three levels of maintenance (organizational, intermediate, depot). Repair is performed at all three levels; bulk of repair for shipboard equipment performed at organizational level. Limited use of outside repair sources.	Essentially three levels of maintenance.	CAAM concentrates most repair at depot and makes extensive use of warranty repair. DN concentrates most repair at organizational level.

✓

procedures they employ in commercial procurements. If a market environment equivalent to the airlines environment is created for military procurement, it is expected that contractors will adapt equipments at their own expense in anticipation of possible sales.

The selection of the contractor is considerably less formal in the CAAM. In some cases, an offeror will be solicited to reconsider his bid in view of a competitor's offer of a better combination of his features. However, irresponsible low bidders are eliminated from the market since either their product will be inferior because of design or manufacturing shortcuts, or their selling price will not support their continuation in business. Revised offers can include price, performance, or other elements; but the award does not exclude the unsuccessful offerors from the market, since other purchases by other airlines can be expected in the immediate future. This latter point is a significant aspect of the CAAM. Anticipation of future purchases provides for continuation of competition throughout the entire production-procurement-operation cycle. The key is the use of the form-fit-function, open forum, industry-developed specifications, and segmented procurement, so that if one manufacturer proves to be incapable of providing the desired product, there are alternative sources. It is also of interest that airline procurements involve small quantities over a longer period and that no single buyer dominates the market.

CHAPTER SIX

FEASIBILITY ANALYSIS

This chapter discusses the feasibility of implementing elements of the CAAM into the Navy's combat system architecture program. Of the CAAM acquisition elements investigated in Chapter Five, six were determined to have the greatest potential for implementation in the CSA program. The four not considered feasible were Scope of Acquisition; Research Development, Test and Evaluation; Source Selection Criteria; and Procurement Cost. Generally, all of these activities are now used in Navy procurements and there was not a significant new element to be adapted into CSA. The six feasible elements are:

- . acquisition program phases
- . competition
- . procurement package
- . equipment development
- . warranty provisions
- . configuration management

The remainder of this chapter further develops the feasibility of implementing these elements in the CSA program.

6.1 ACQUISITION PROGRAM PHASES

The formal, highly structured acquisition methodology within DoD/Navy presents few opportunities for change within ACAT I and II programs. Some similarities to the CAAM and U.S. Air Force acquisition process do exist within ACAT III and IV. ACAT IV programs possess a greater potential for utilization of CAAM elements due to the flexibility encouraged by CNM. Incorporating elements and techniques of the CAAM appear to be feasible for CSA programs that will fall within ACAT III and IV.

6.2 COMPETITION

Competition within DN acquisitions generally ceases upon contract award, while the CAAM promotes competition throughout the equipment life-cycle. It is important to note, however, the post-acquisition (life-cycle) competitive forces within the CAAM work to the advantage of

the airlines industry in a following acquisition. That is, the current reliability and support record of the prospective vendor is heavily weighed in choosing the winner of a following competitive procurement.

The Office of Management Budget (OMB) Circular A-109 promotes competition for ACAT I programs in a structured fashion but does not include the operational phase of the equipment. Other instructions which govern DN acquisition such as SECNAVINST 5000.1A, 17 November 1978 - System Acquisition in the Department of the Navy and OPNAVINST 5000.42, 3 March 1976 - Weapon Systems Selection and Planning allow for competition at all ACAT levels but again do not promote the concept for the operational phase. A revision of the acquisition instructions would be required to provide for consideration of the prior performance record of the proposer. With such changes, this CAAM element would be feasible within ACAT III and IV of the CSA program.

6.3 PROCUREMENT PACKAGE

Within a CAAM procurement package, heavy emphasis is placed on logistics support considerations such as availability and cost of spare parts, service, in-service reliability and other items affecting product support. A DN procurement package places emphasis on the technical specification and the proposer is not as heavily evaluated on his prior performance in logistic support areas as with the CAAM. Procurement package requirements to provide for stronger emphasis on manufacturer support during the equipment life-cycle are considered feasible for the CSA program. Contractual requirements placing greater emphasis of mean-time-between-failures/repair (MTBF/MTBR), contractor supported maintenance, rotatable spares, and so on, during the equipment life-cycle could be structured within the CSA acquisition methods.

6.4 EQUIPMENT DEVELOPMENT

Under the CAAM, manufacturers develop avionic equipment, at their own expense, and usually concurrently with the development of the equipment specification (ARINC Characteristic). Implementing a similar concept in the DN acquisition process is feasible and could be initiated on mature technology equipments requiring relatively small development costs. Under current DN acquisition regulations, large investments of company funds to design and build high technology prototype equipment for marketing purposes is risky at best. Industry currently invests their own funds to produce designs and/or equipments based on stated needs by the Navy. The risk of selling the development is borne solely by the developing company since the Navy is not obligated to buy.

As part of the strategy to have industry support some of the developmental costs, use of F³ specifications have been shown to be feasible. Both the CAAM and the Air Force - for the INS procurement - have had success employing the F³ specification. Changes to DN instructions are not presently anticipated, but major changes to the DN procurement package instructions will be necessary to implement this element of the CAAM.

6.5 WARRANTY PROVISIONS

Use of Reliability Improvement Warranty (RIW) has been used successfully by both the Navy and Air Force. ARINC Research has performed considerable warranty related studies, the implementation of which has resulted in successful equipment and system acquisitions. One example is the Shipboard Non-tactical Automatic Data Processing Program (SNAP). A warranty concept is considered feasible for implementation in acquisition of combat system equipments.

6.6 CONFIGURATION MANAGEMENT

An ARINC characteristic controls the configuration of airline avionics in terms of form, fit and function. An F³ specification accomplishes the same within the Air Force. Relaxing the strict control of configuration of the internal design of an equipment is feasible for less complex or technologically mature items such as power supplies and display equipment. Such items are more common aboard ship than a weapon system for example, and relaxation could be more readily accepted. Existing Navy specifications and military standards for configuration management will not require modification but selective application of these will be necessary during an acquisition.

6.7 SUMMARY

There are several elements of the CAAM that are feasible for implementation in the Navy CSA program. Those elements of the CAAM that appear feasible and may provide the greatest potential for benefit to the CSA program are:

- acquisition program phases
- competition
- procurement package
- equipment development
- warranty provisions
- configuration management

Some of these acquisition techniques are currently being employed in varying degrees for Navy acquisitions. The uniqueness of the CAAM and the Air Force's adaptation in its avionics acquisition methodology results from these concepts being grouped into a single strategy and employed in a unified manner.

CHAPTER SEVEN

CONCLUSIONS AND RECOMMENDATIONS

This chapter presents the major conclusions and recommendations of the study, resulting from the comparisons presented in Chapter Five. It also addresses the feasibility of implementing airline procurement concepts in the Navy CSA program.

7.1 CONCLUSIONS

The Navy CSA program has thus far not specified an acquisition methodology. The methodology available to the CSA program are currently described by the DN Acquisition Categories I through IV. Adaptation of CAAM elements are likely not feasible for ACAT I and II. Consideration should be given to ACAT III and IV for adopting CAAM elements.

Specific CAAM techniques are feasible for implementation in the Navy CSA program. Several CAAM techniques have been adapted by the Air Force for acquisition of avionics and the apparent success of the program indicates potential for Navy CSA program acquisitions.

The CAAM is an acquisition process directed toward the procurement of standardized avionic equipment. The CAAM provides the airlines with high-quality avionics at competitive prices.

The scope and structure of the CAAM and the U.S. Air Force avionics acquisition methodology equate most closely to the Navy ACAT III and IV. Both categories emphasize informal phases and flexibility throughout the conduct of their respective methodologies.

The CAAM exploits competition throughout the equipment life cycle. Industry is expected to participate in equipment design, fund prototype development, and remain actively involved to assure the optimum performance of the equipment. Rarely are procurements limited to a single source. The DN tends to limit competition to a single source during the advanced development, engineering development, and production phases.

The CAAM actively solicits industry participation throughout the entire acquisition process. The use of open-forum meetings becomes a

standard practice for analyzing requirements, developing equipment specifications, and providing maintenance feedback.

The Air Force avionics acquisition methodology employs similar involvement of industry through open-forum-type meetings. Of equal importance, this methodology has empowered a single Air Force agency to plan and coordinate the participation of all Air Force staff, support, and operational activities in the open-forum meetings and implementation of the process. Industry as an entity is involved in the early stages of the DN methodology but becomes less involved as the process progresses.

All methodologies are concerned with prospective manufacturer production cost estimates. The CAAM and USAF methodology are concerned with the supplier's prior performance to the F³ specification and how responsive he has supported his product. Both solicit proposals only after pre-qualifying the prospective sources.

Specifications are used to varying degrees in the three methodologies. The CAAM stresses the use of F³ specifications and uses industry's inputs to develop the final specification. The specification is the cornerstone for negotiating product contracts. The DN specification is more complex and encompassing; it goes beyond F³ in specifying design and fabrication criteria.

Recent direction within the DN, however, provides for simplifying the specifications through tailoring and is oriented toward reducing the life-cycle cost related to the specific acquisition. However, this technique has not enjoyed wide acceptance by acquisition managers.

Essentially all methodologies recognize the same three levels of maintenance (depot, intermediate, and organizational). The CAAM concentrates most repair at the depot level while making extensive use of warranty repair. Suppliers to the airline typically include warranty in their cost quotations.

The Navy and the Air Force have negotiated RIW contractual agreements with proven success in aircraft programs such as the F-14, F-111, and F-4. These RIW agreements provided documented reliability and performance improvements which might not have been expected had standard contractual agreements been let.

7.2 RECOMMENDATIONS

The recommendations listed below address those areas which are considered to have proven most successful for the CAAM and which offer the greatest potential for adaptation into the Navy CSA program. The following actions are recommended on the basis of the study's conclusions:

- . The Navy CSA program should consider implementing those CAAM techniques determined to be feasible and adapt these techniques to the acquisition of designated CSA program systems and equipments.

- The CSA program should develop the requisite planning to coordinate implementation of CAAM elements into current and future acquisition strategies.
- The CSA program should invite industry representatives to participate in an open-forum process for establishment and review of specifications necessary to achieve CSA program requirements for systems or equipments. This process should consider systems and equipments with a high probability of utilization in a combat system. Generic equipments such as console displays, power supplies, radar displays, and similar technologically nature devices with moderate to high production requirements should be considered.
- Certain systems and equipments identified by the CSA program should be technically described and procured through the use of F³-type specifications. At a minimum, tailoring of the requirements utilized for the acquisition of these systems and equipments should be conducted.
- The CSA program should use contract negotiation strategies that emphasize competition throughout the system or equipment life cycle. Modifications to existing procurement regulations to define and encourage this type of competition will need to be drafted, approved and promulgated.

APPENDIX A

INTERPRETATION OF DIAGRAMS

At the direction of the NRL technical staff ARINC Research used a graphical method for representing the acquisition concepts. The diagrams presented in this report have been presented in a fashion similar to the Structured Analysis and Design Techniques (SADT) methodology developed by the Software Technology Company (SOFTech). ARINC Research Corporation employed similar concepts as those of the SADT methodology for diagramming top-down system/work-breakdown structures.

Readers familiar with the SADT methodology should be able to understand the information diagramed in this report. For those readers not familiar with the SADT, the following presents a brief explanation of the essential diagraming mechanics that should be understood.

The diagrams represent a top-down hierarchical configuration -- the highest level is presented and subsequently broken down into its inherent subsets. Numbering is used to indicate the relationship between higher- and lower-level diagrams. The numbers are established at the highest level and added as the subsets are diagramed. The boxes represent an activity or function. The arrows represent relationships between the functions. Input arrows enter a box on the left and are designated by an I and a subset number (I₁, I₂, etc.). Output arrows leave the box on the right. Control arrows enter a box on the top and are designated C₁, C₂, etc. The person, process, or agency involved in effecting the function enters the box from the bottom and are designated M₁, M₂, etc.

A basic description of the system used to identify these diagrams is necessary to the reader's understanding of the diagrams. The first letter of each methodology is used to identify the diagrams, i.e., A = Air Force, C = Commercial, and N = Navy. Alphanumerics are then assigned in sequential order to each of the top-down breakdown tiers. All "0" diagrams represent the highest, most basic breakdown level. Diagram C-0 is the object function for the CAAM. C-0A represents the first-level breakdown of the object function. Numbers 1, ..4 represent the individual functions that constitute the first-level breakdowns. Diagram C-1 is the first function performed in the first tier breakdown of the process. If a second-level breakdown were presented, a double set of numerals would be used. Thus C-11 would be the first function in the second tier breakdown.

The letter I represents an information diagram. These diagrams are numbered in relation to their positioning between tiered breakdowns. For example, C-1II represents the first informational diagram found, which amplifies some portion of the first level function C-1.

APPENDIX B

**BRIEFING PACKAGE FOR THE PROCUREMENT CONCEPT FEASIBILITY
STUDY OF THE COMBAT SYSTEM ARCHITECTURE (CSA) PROGRAM**

This appendix presents the briefing package prepared for this study effort.

THE FORMAT FOR THIS BRIEFING ON THE CSA PROCUREMENT
CONCEPT FEASIBILITY STUDY IS AS SHOWN. THIS BRIEFING
PROVIDES THE RESULTS OF A DOCUMENTED STUDY CONDUCTED
BY ARINC RESEARCH CORPORATION.

BRIEFING FORMAT

INTRODUCTION

STUDY OBJECTIVE

STUDY RESULTS

STUDY CONCLUSIONS

RECOMMENDATIONS

APPENDIX - ACQUISITION METHODOLOGIES DETAILED

INTRODUCTION

INCREASING EMPHASIS ON REDUCING COSTS AND IMPROVING EFFECTIVENESS OF NEWLY ACQUIRED SYSTEMS/EQUIPMENTS IS BEING ADVOCATED WITHIN THE DOD.

THE NAVSEA COMBAT SYSTEM ARCHITECTURE PROGRAM IS RESPONSIBLE TO PROVIDE "THE MANAGEMENT AND TECHNICAL DISCIPLINE WHICH INVOKES A STRUCTURED SYSTEM APPROACH TO PRODUCE A SHIP COMBAT SYSTEM DESIGN."

IN SUPPORT OF THE DOD GOAL, THE CSA OFFICE INITIATED A STUDY TO INVESTIGATE DIFFERENT ACQUISITION TECHNIQUES. TWO AREAS BEING FOCUSED ON BY THIS STUDY ARE:

- COMMERCIAL AIRLINES ACQUISITION METHODOLOGY (CAAM)
- U. S. AIR FORCE AVIONICS ACQUISITION METHODOLOGY

THESE ACQUISITION METHODOLOGIES HAVE BEEN ESTABLISHED WITH A GOAL SIMILAR TO THAT OF THE DOD.

INTRODUCTION

DOD ACQUISITION EMPHASIS

- REDUCED Cost
- IMPROVED SYSTEM EFFECTIVENESS

NAVSEA CSA PROGRAM

- IMPLEMENT STRUCTURED SYSTEM APPROACH TO
SHIP COMBAT SYSTEM DESIGN
- SUPPORT DOD GOAL

THE OBJECTIVE OF THIS STUDY WAS TO DETERMINE THE FEASIBILITY OF APPLYING COMMERCIAL AIRLINE ACQUISITION TECHNIQUES TO THE NAVY CSA PROGRAM IN ORDER TO EFFECT TECHNOLOGY AND DEVELOPMENT PLANNING ASSOCIATED WITH COST REDUCTION AND IMPROVED SYSTEM EFFECTIVENESS.

THE STUDY OBJECTIVE WAS ACCOMPLISHED BY CONDUCT OF FIVE TASKS:

1. SUMMARIZE COMMERCIAL AIRLINE ACQUISITION METHODOLOGY
2. REVIEW AIR FORCE AVIONICS ACQUISITION METHODOLOGY
3. IDENTIFY NAVY CSA ACQUISITION METHODOLOGY
4. COMPARE NAVY TO AIR FORCE AND AIRLINE METHODOLOGIES
5. ASSESS FEASIBILITY OF IMPLEMENTATION OF AIRLINE CONCEPTS IN NAVY CSA PROGRAM

A GRAPHICAL LANGUAGE WAS USED TO DEPICT HIERARCHICAL RELATIONSHIPS.

STUDY OBJECTIVE

**DETERMINE THE FEASIBILITY OF APPLYING COMMERCIAL AIRLINE ACQUISITION
TECHNIQUES TO THE NAVY CSA PROGRAM STUDY TASKS:**

- 1. SUMMARIZE COMMERCIAL AIRLINE ACQUISITION METHODOLOGY**
- 2. REVIEW AND SUMMARIZE AIR FORCE AVIONICS ACQUISITION METHODOLOGY**
- 3. IDENTIFY NAVY ACQUISITION METHODOLOGY FOR CSA**
- 4. COMPARE NAVY TO AIR FORCE AND AIRLINE METHODOLOGIES**
- 5. ASSESS FEASIBILITIES OF IMPLEMENTATION OF AIRLINE
CONCEPTS IN NAVY CSA PROGRAM**

THE RESULTS OF THIS STUDY ARE SUMMARIZED IN THE FOLLOWING FOUR CATEGORIES

STRUCTURE

CAAM PROCESS DOES NOT INCLUDE FORMALIZED PHASES. ACAT I
AND II ARE THE MOST FORMALIZED NAVY ACQUISITION CATEGORIES.
ACAT III AND IV ARE LESS RIGID AND MORE CLOSELY ALIGNED
WITH THE CAAM IN SCOPE.

STUDY RESULTS

STRUCTURE

- CAAM DOES NOT CONSIST OF FORMALIZED PHASES.
- NAVY ACQUISITION CATEGORIES I AND II CONSIST OF FORMALIZED PHASES
- NAVY ACQUISITION CATEGORIES III AND IV MORE CLOSELY RESEMBLE THE CAAM IN SCOPE AND FORMALITY.

RDT&E

ALL METHODOLOGIES INVOLVE VARYING AMOUNTS OF MANUFACTURE INVESTMENT. MOST EQUIPMENT IS DESIGNED AND DEVELOPED AT MANUFACTURER EXPENSE BY THE CAAM. THE U.S. AIR FORCE AVIONICS ACQUISITION METHODOLOGY INVOKED THIS CONCEPT FOR THE F3 INERTIAL NAVIGATION SYSTEM PROCUREMENT.

ALL METHODOLOGIES REQUIRE SOME QUALITY CONTROL AND ACCEPTANCE TESTS. THE CAAM USES STATE-OF-THE-ART TECHNIQUES WITH LIMITED R&D OR T&E FUNDED BY THE PURCHASERS. TESTING IS LIMITED TO PROOF OF PERFORMANCE.

STUDY RESULTS (CON'T)

RESEARCH, DEVELOPMENT, TEST AND EVALUATION (RDT&E)

- CAAM RELIES ON INDUSTRY INVESTMENT FOR AVIONICS RDT&E.
- CAAM AND USAF F³ ACQUISITIONS FOSTER EQUIPMENT DESIGN AND DEVELOPMENT AT MANUFACTURERS EXPENSE.
- NAVY ACQUISITION FUNDS RDT&E.

COMPETITION

COMPETITION IS USED ON ALL PROCESSES FOR VARYING PURPOSES. CAAM EXPLOITS COMPETITION THROUGHOUT THE LIFE CYCLE. DN ESSENTIALLY LIMITS MOST PROCUREMENTS TO SINGLE SOURCE.

ALL METHODOLOGIES ARE CONCERNED WITH PROSPECTIVE MANUFACTURERS PRODUCTION ESTIMATES. CAAM AND USAF ARE CONCERNED WITH THE SUPPLIER'S PERFORMANCE TO THE SPECIFICATION PRIOR TO NEGOTIATION. THE CAAM SOLICITS PROPOSALS ONLY AFTER QUALIFYING SOURCES.

ALL METHODOLOGIES NEGOTIATE TO ACHIEVE LOWEST COST. SUPPLIERS TO THE AIRLINES TYPICALLY INCLUDE WARRANTY IN THEIR COST QUOTATIONS.

STUDY RESULTS (CON'T)

COMPETITION

- CAAM EXPLOITS COMPETITION THROUGHOUT AVIONICS LIFE UTILIZING F3 TYPE SPECIFICATION.
- NAVY ACQUISITION LIMITS MOST PROCUREMENTS TO SINGLE SOURCE USING MORE RESTRICTIVE TYPE SPECIFICATIONS.

LOGISTICS SUPPORT

ESSENTIALLY ALL METHODOLOGIES RECOGNIZED THE SAME THREE LEVELS OF MAINTENANCE. THE CAAM CONCENTRATES MOST REPAIR AT THE DEPOT LEVEL WHILE MAKING EXTENSIVE USE OF WARRANTY REPAIR. DN CONCENTRATES MOST REPAIR AT THE ORGANIZATIONAL LEVEL.

STUDY RESULTS (CON'T)

LOGISTICS SUPPORT

- ALL METHODOLOGIES RECOGNIZE SIMILAR LEVELS OF MAINTENANCE (DEPOT, INTERMEDIATE, AND ORGANIZATIONAL).
- CAAM CONCENTRATES MOST REPAIR AT DEPOT LEVEL USING WARRANTY.
- NAVY CONCENTRATES REPAIRS AT ORGANIZATIONAL LEVEL WITHOUT WARRANTY EMPHASIS.

ALL PROCESSES NORMALLY FOLLOW A GENERAL SEQUENCE OF EVENTS FOR THE DURATION OF THEIR ACQUISITION PROGRAMS. THE CAAM DOES NOT FOLLOW THE HIGHLY STRUCTURED PHASES OR FORMALIZED PHASES FOUND IN THE NAVY'S ACAT I AND II.

CERTAIN TECHNIQUES FOUND IN THE CAAM ARE FEASIBLE FOR IMPLEMENTATION IN THE NAVY CSA PROGRAM. THREE OF THESE OFFERING THE STRONGEST POTENTIAL ARE SHOWN.

STUDY CONCLUSIONS

- STRUCTURE OF CAAM AND USAF AVIONICS ACQUISITION METHODOLOGY ARE SIMILAR AND MOST NEARLY EQUATE TO NAVY ACAT III & IV.
- CERTAIN CAAM TECHNIQUES ARE FEASIBLE FOR IMPLEMENTATION IN THE NAVY CSA PROGRAM.
- INDUSTRY PARTICIPATION IN ANALYSIS OF REQUIREMENTS
 - LESS RESTRICTIVE DESIGN AND PRODUCTION REQUIREMENTS
 - INCREASE COMPETITION DURING SYSTEM LIFE.

THE FOLLOWING CONCEPTS FROM THE CAAM ARE FEASIBLE FOR
IMPLEMENTATION:

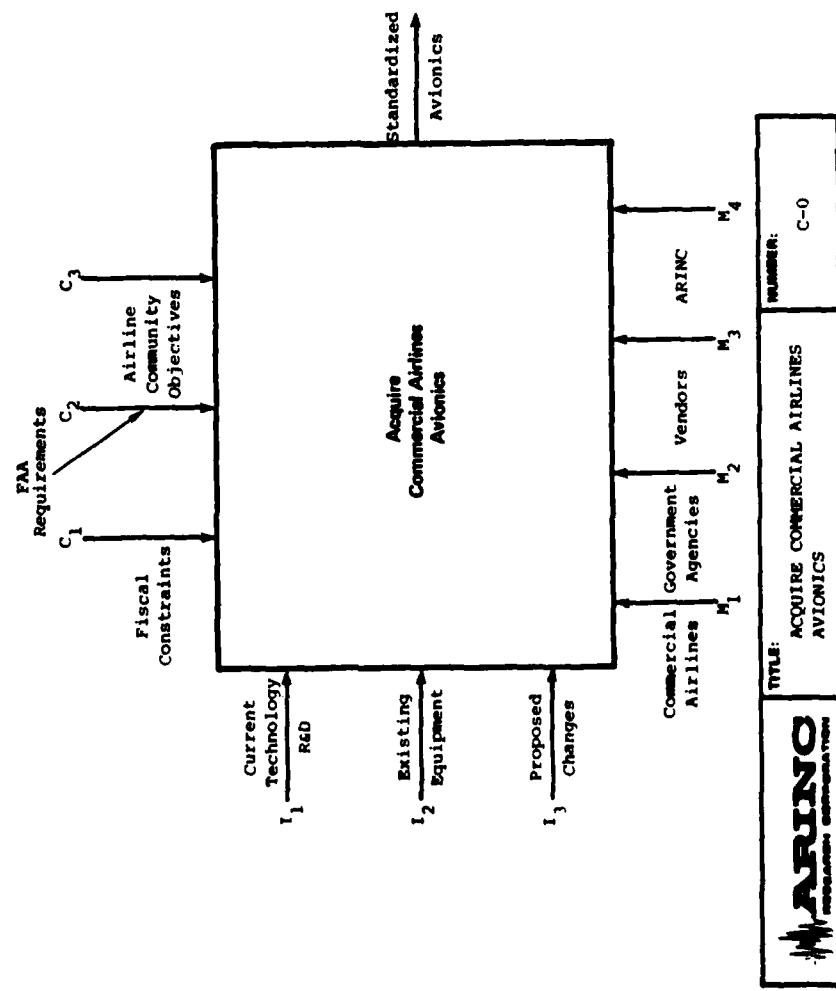
- UTILIZATION OF INDUSTRIAL REPRESENTATIVES TO PARTICIPATE IN REVIEW AND ESTABLISHMENT OF SPECIFICATIONS NECESSARY TO MEET CSA PROGRAM REQUIREMENTS.
- UTILIZATION OF LIMITED F³ TYPE SPECIFICATION. SOME COMBINATION OF EITHER FORM, FIT, OR FUNCTION ALLOWING PRODUCER FLEXIBILITY IN DESIGNING REQUIRED FUNCTION.
- UTILIZATION OF INNOVATIVE CONTRACT NEGOTIATION STRATEGIES EMPHASIZING LIFE-CYCLE COMPETITION.

RECOMMENDATIONS

- UTILIZE INDUSTRY REPRESENTATIVES TO PARTICIPATE IN THE REVIEW AND ESTABLISHMENT OF SPECIFICATIONS NECESSARY TO MEET CSA PROGRAM REQUIREMENTS
- UTILIZE LIMITED F³ TYPE SPECIFICATIONS
- UTILIZE INNOVATIVE CONTRACT NEGOTIATION STRATEGIES EMPHASIZING LIFE-CYCLE COMPETITION

APPENDIX - ACQUISITION METHODOLOGIES DETAILED

THE TOP LEVEL DIAGRAM OF THE COMMERCIAL AIRLINES ACQUISITION METHODOLOGY IS SHOWN. THE MOST UNIQUE FEATURE OF THIS METHODOLOGY IS THE ACTIVE PARTICIPATION OF INDUSTRY (AIRFRAME/AVIONICS MANUFACTURERS) THROUGHOUT THE ACQUISITION CYCLE.



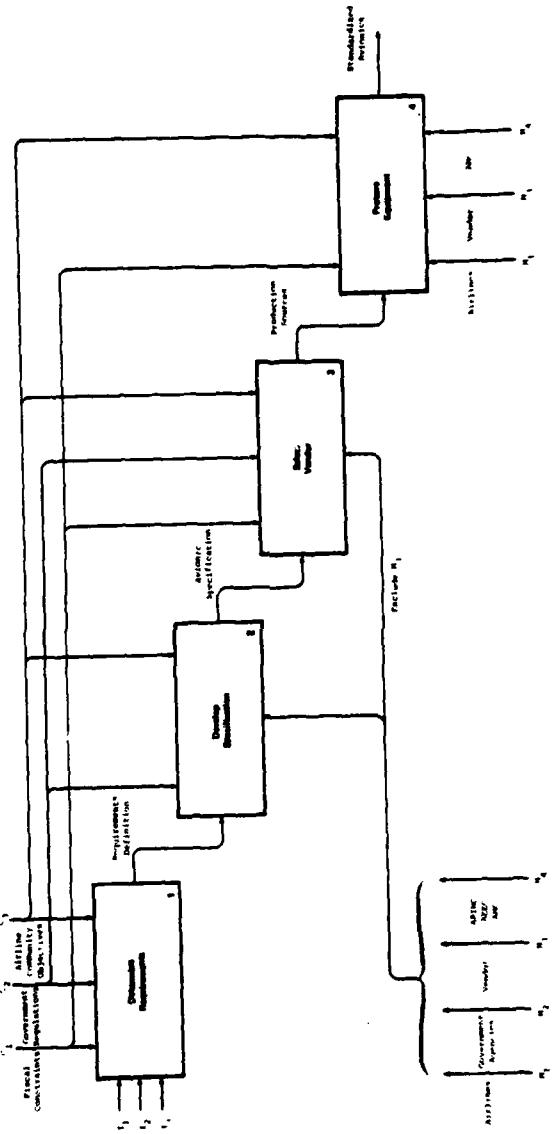
THE AIRLINES ACQUISITION METHODOLOGY IS COMPRISED OF FOUR BASIC AND SEQUENTIAL FUNCTIONS.

1. DETERMINE REQUIREMENTS
2. DEVELOP SPECIFICATIONS
3. SELECT VENDOR(S)
4. PROCUREMENT EQUIPMENT

THE PARTICIPATING AIRLINES ACT AS ONE IN THE PROCESSES INVOLVED IN THE FIRST TWO FUNCTIONS BUT OFTEN PROCEED ON THEIR OWN INITIATIVES IN FINAL TWO FUNCTIONS.

KEY CHARACTERISTICS ARE:

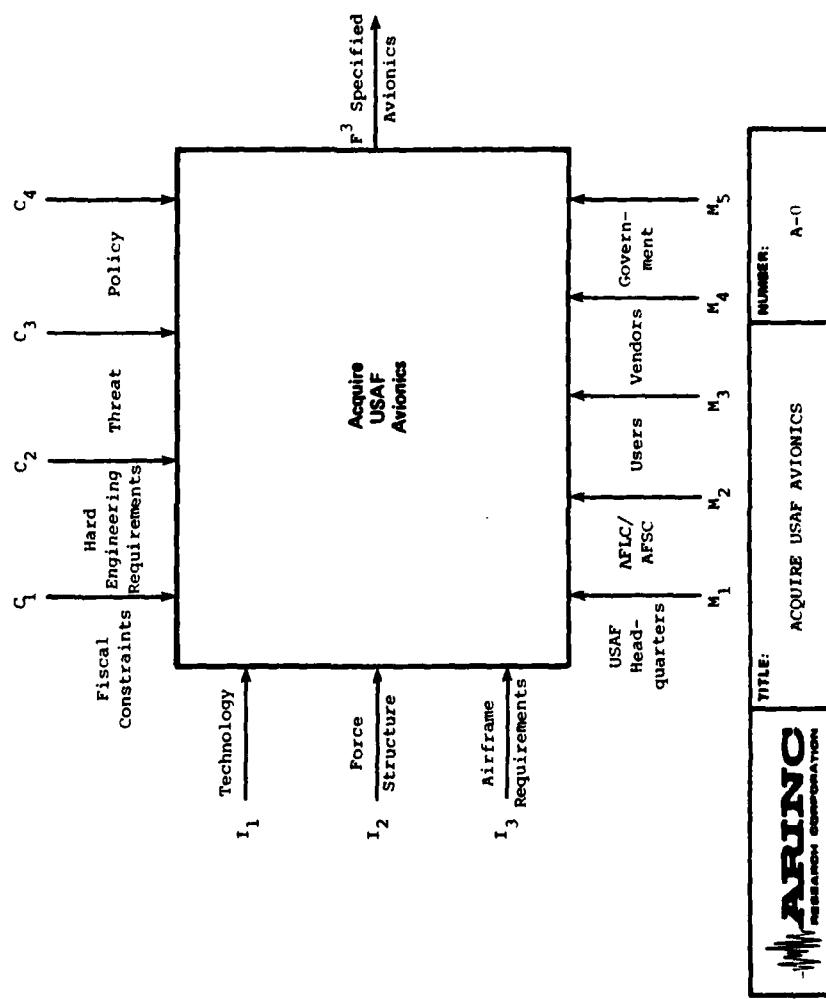
- NO FORMAL STRUCTURE
- PRIMARY CONCERN ARE COST, RELIABILITY, AND FORM, FIT, AND FUNCTION, (FF) STANDARDIZATION
- LIFE-SPAN COMPETITION
- GOVERNING TECHNICAL AUTHORITY (ARINC) APPROVES AVIONICS SPECIFICATIONS
- COMPETING VENDORS TYPICALLY DEVELOP EQUIPMENT AT OWN EXPENSE IN PARTICIPATION
- LITTLE R&D SPONSORED BY AIRLINES
- EXTENSIVE USE OF WARRANTIES AND WARRANTY SUPPORTED REPAIR
- MAINTENANCE ACTIONS AND HISTORY ARE DOCUMENTED IN AN OPEN FORUM
- PAST VENDOR PERFORMANCE BECOMES MAJOR SELECTION FACTOR



AIRINC RESEARCH CORPORATION	TITLE: ACQUIRE COMMERCIAL AIRLINES AVIONICS	NUMBER: C-0A
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THE TOP LEVEL DIAGRAM OF THE U.S. AIR FORCE AVIONICS ACQUISITION
METHODOLOGY IS SHOWN.

THE MOST UNIQUE FEATURE OF THIS METHODOLOGY IS THE ATTEMPT
TO CREATE COMPETITIVE FORCES WHICH COULD ULTIMATELY REDUCE
COSTS BUT NOT AT THE EXPENSE OF FINISHED PRODUCT.



THE U.S. AIR FORCE AVIONICS ACQUISITION METHODOLOGY IS COMPRISED OF SIX BASIC AND SEQUENTIAL FUNCTIONS AS SHOWN.

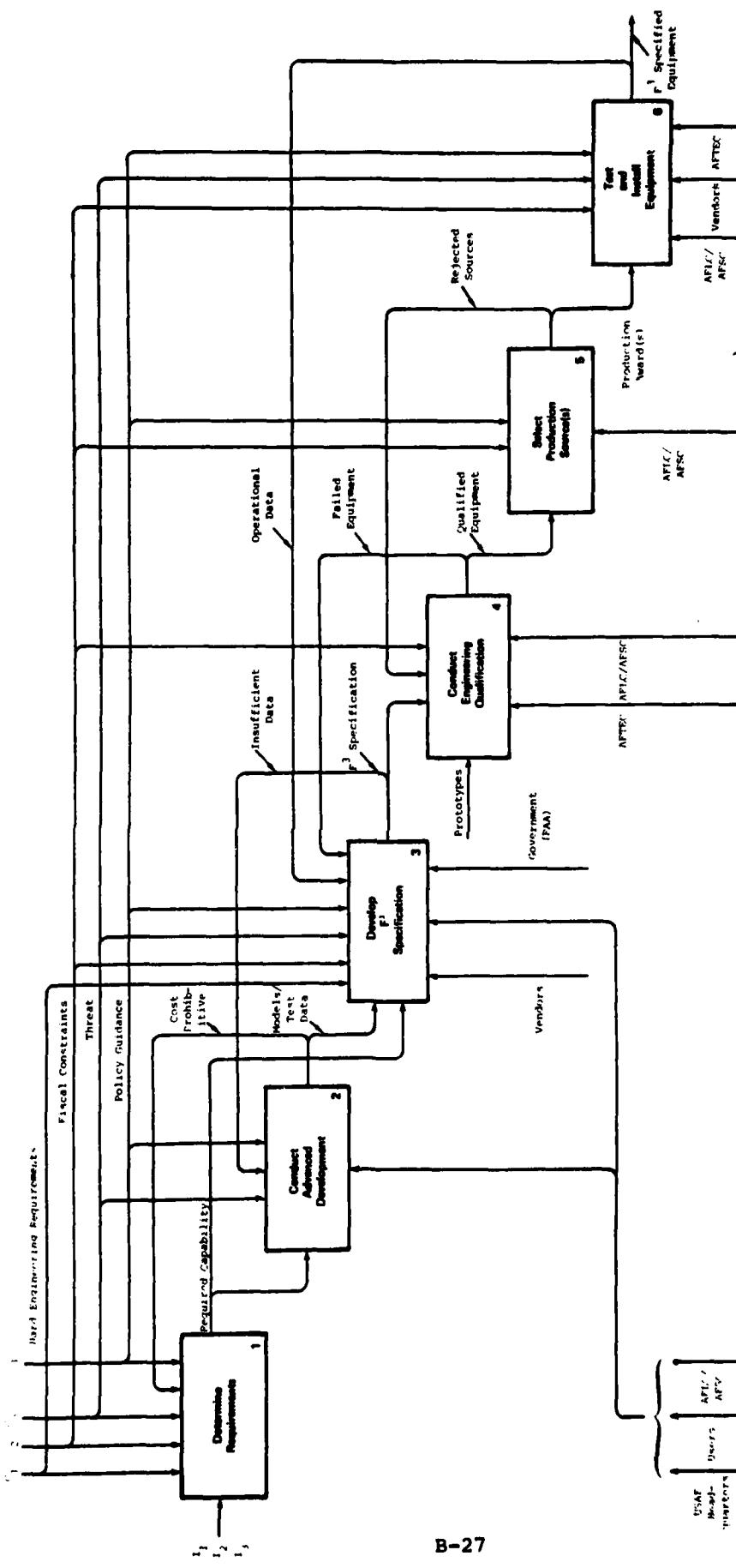
1. DETERMINE REQUIREMENTS
2. CONDUCT ADVANCED DEVELOPMENT
3. DEVELOP F₃ SPECIFICATION
4. CONDUCT ENGINEERING QUALIFICATIONS
5. SELECT PRODUCTION SOURCES
6. TEST AND INSTALL EQUIPMENT

CONDUCT OF ADVANCE DEVELOPMENT IS OPTIONAL DEPENDENT UPON THE TECHNOLOGY AVAILABLE AND DEVELOPMENT FUNDS INVESTED.

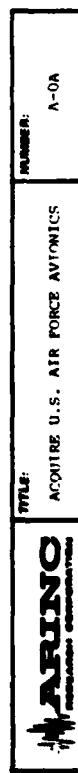
KEY CHARACTERISTICS ARE:

- INCREASED COMMUNICATIONS BETWEEN ALL INVOLVED ECHELONS OF THE AIR FORCE TO DETERMINE ANNUAL AIR FORCE ACQUISITION STRATEGY
- ESTABLISHMENT OF A SINGLE AGENCY TO CONSOLIDATE REQUIREMENTS AND PROCURE AVIONICS

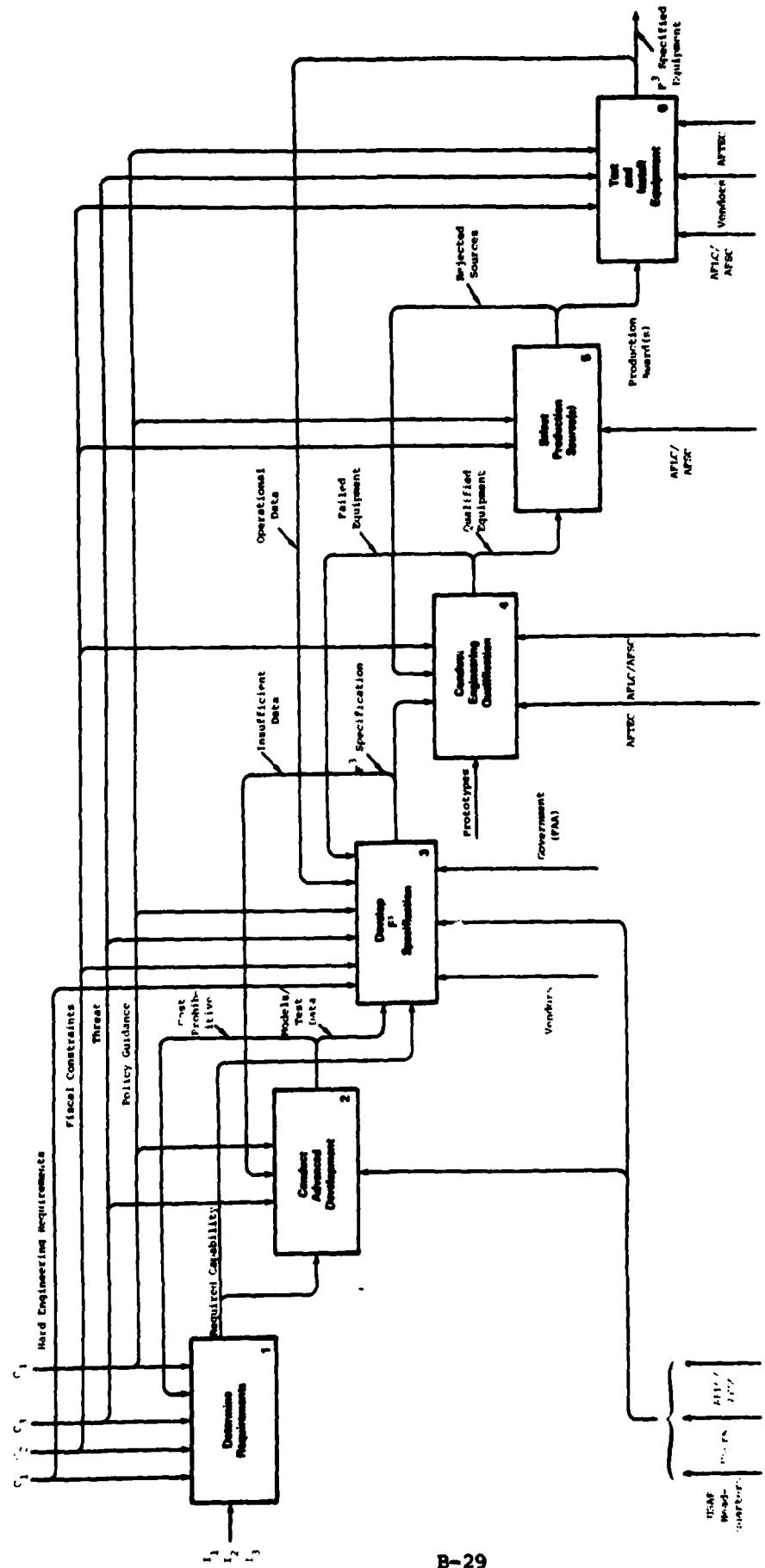
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- PROMOTION OF TECHNOLOGICAL INNOVATION WITH REGARD TO RELIABILITY, MAINTAINABILITY, AND PRODUCIBILITY THROUGH RELAXATION OF GOVERNMENT CONTROL
- COMPETITIVE PERIODIC PROCUREMENTS VERSUS SOLE-SOURCE MULTI-YEAR AWARDS
- LONG TERM INITIAL WARRANTY OR SIMILAR FORM OF CONTRACTOR SUPPORT WITH ECONOMIC INCENTIVES
- UTILIZATION OF F³ SPECIFICATION TO STIMULATE COMPETITIVE MARKET FORCES WHILE ENCOURAGING MANUFACTURING INITIATIVE
- UTILIZATION OF USER/INDUSTRY OPEN FORUM ACTIVITY TO BRING INDUSTRY'S IDEAS INTO PLAY DURING THE AVIONICS DEVELOPMENT PROCESS
- U. S. AIR FORCE AVIONICS ACQUISITION POLICY FORMALIZED AND PROMULGATED AS AF REGULATION 800.28



MARINO	Title: ACQURE U.S. AIR FORCE AVIONICS	Number: A-0a
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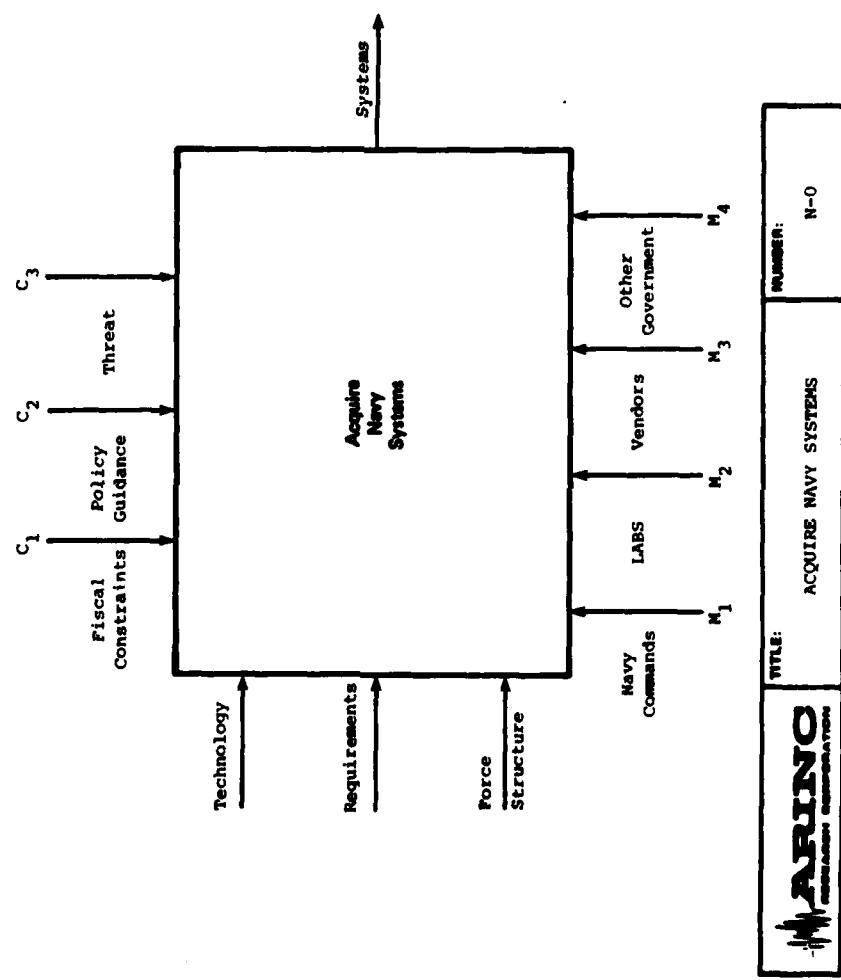
THE TOP LEVEL DIAGRAM OF THE U.S. NAVY ACQUISITION METHODOLOGY IS SHOWN. THIS METHODOLOGY IS STRUCTURED AS FOUR DISTINCT ACQUISITION CATEGORIES (ACAT) AS DEFINED BY RDT&E AND PRODUCTION COST.

- ACAT I - RDT&E > \$50 MILLION/PRODUCTION > \$200 MILLION
- ACAT II - RDT&E > \$20 MILLION/PRODUCTION > \$50 MILLION
- ACAT III - RDT&E > \$5 MILLION/PRODUCTION > \$20 MILLION
- ACAT IV - PROGRAMS NOT IN ACAT I, II, OR III

DECISION MAKING AUTHORITY FOR THE ACAT LEVELS ARE:

- ACAT I - SECDEF/DEPSECDEF
- ACAT II - SECNAV
- ACAT III - PROGRAM SPONSOR (DCNO/DMSO)
- ACAT IV - CHNAVMAT (DELEGATED TO SYSCOM)

THE MOST UNIQUE FEATURE OF THE NAVY ACQUISITION METHODOLOGY IS THE DISTINCTION BETWEEN ACQUISITION CATEGORIES. THE COMBAT SYSTEM ARCHITECTURE PROGRAM HAS NOT YET PROMULGATED ITS POLICY GUIDANCE CONCERNING SYSTEM ACQUISITION. THEREFORE, A SUPPOSITION IS THAT CSA POLICY IS REFLECTED IN EXISTING NAVY/DOD ACQUISITION DIRECTIVES FOR ACAT II.



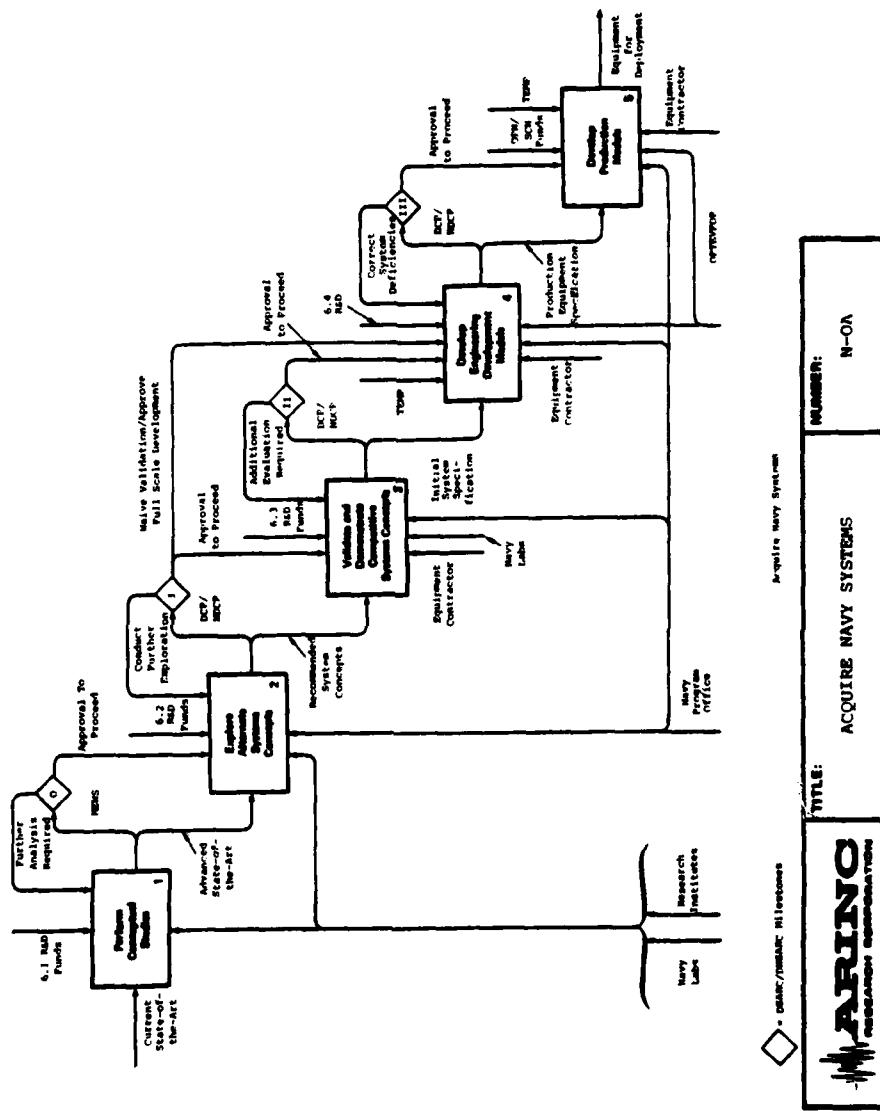
THE NAVY ACQUISITION METHODOLOGY FOR AN ACAT I CONSISTS OF FIVE BASIC FUNCTIONS REQUIRING FORMAL REVIEW AS SHOWN.

1. PERFORM CONCEPTUAL STUDIES
2. EXPLORE ALTERNATIVE SYSTEM CONCEPTS
3. VALIDATE/DEMONSTRATE COMPETITIVE SYSTEMS
4. CONDUCT FULL-SCALE ENGINEERING DEVELOPMENT
5. DEVELOP PRODUCTION MODELS

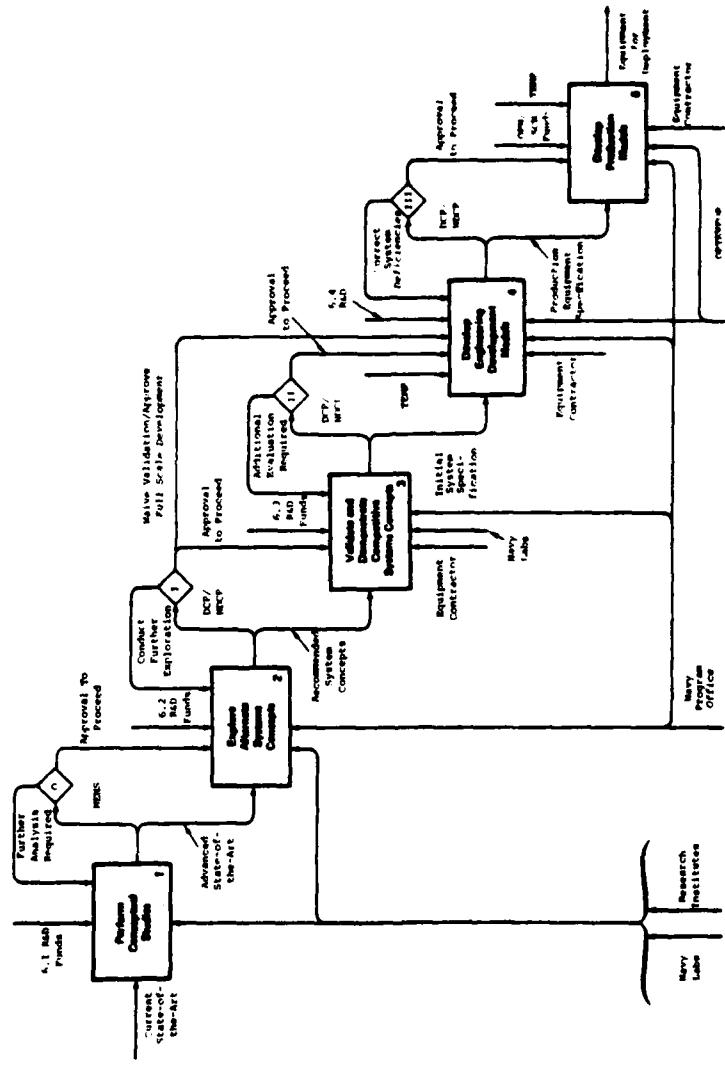
KEY CHARACTERISTICS ARE:

- USE OF NAVY/DOD ACQUISITION DIRECTIVES IS THE BASIS OF DESCRIPTION OF THE CSA PROGRAM ACQUISITION POLICY
- NAVY ACQUISITION PROCESS IS FORMAL AND PAPER WORK ORIENTED

(CONTINUED)



- INVOLVEMENT OF INDUSTRY IN THE ACQUISITION PROCESS IS ESSENTIALLY BROUGHT ABOUT ONLY WITH CORRESPONDING MONETARY INVESTMENTS.
- NAVY DICTATES RIGID SPECIFICATION TO INTERESTED CONTRACTORS AND INVESTS CONSIDERABLE FUNDS FOR SUBSEQUENT RESEARCH, DEVELOPMENT, AND TESTING PROGRAMS.
- NAVY CONTRACTUAL TERMS ARE ESSENTIALLY HARDWARE ORIENTED WITH ADDITIONAL COSTS ACCRUED FOR TRAINING, LOGISTIC SUPPORT, TECHNICAL DATA, ETC.
- ACAT IV PROGRAMS REQUIRE LESS FORMAL REVIEW AND DECISION THAN ACAT I PROGRAMS RESULTING IN MORE FLEXIBILITY SPANNING THE FIVE BASIC FUNCTIONS OF THE NAVY ACQUISITION.



ARINC Aerospace Systems	TITLE: ACQUIRE NAVY SYSTEMS	NUMBER: N-OA
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Acquire Navy System

◆ DCP/MCIV Milestone

COMPARISON OF THE ACQUISITION METHODOLOGIES IS SHOWN FOR NINE SPECIFIC AREAS. THE SIMILARITIES AND DIFFERENCES EMPHASIZED WERE THOSE BETWEEN THE NAVY ACQUISITION METHODOLOGY AND THE CAAM. THE AREAS OF COMPARISON SHOWN WERE REVIEWED TO DETERMINE CONCEPTS FOR POTENTIAL IMPLEMENTATION IN THE CSA PROGRAM. CONCEPTS MOST APPARENT FROM THIS REVIEW WERE EARLY INDUSTRY INVOLVEMENT, LESS RIGID SPECIFICATIONS, AND HIGHER SYSTEM EFFECTIVENESS AT A LOWER PROGRAM COST.

TABLE 5-1 PROGRAM COMPARISONS

AREA OF COMPARISON	CAM ACQUISITION METHODOLOGY	USAF AVIATION ACQUISITION METHODOLOGY FOR F10	ACAT I & IV	ACAT III & IV	DN ACQUISITION METHODOLOGY	SIMILARITIES	DIFFERENCES
Acquisition Program Phases	No formal structure; only general sequence of events.	Formal acquisition policy.	Typically consists of five distinct phases for major system acquisitions. These phases are highly structured and consist of a numbered sequence of events.	Typically consists of five less formally structured phases.	DN process does not include formalized phases. ACAT I & II not formalized at all.	A general sequence of events is normally followed in all processes. ACAT III & IV similar to CAM & USAF.	CAM processes do not include formalized phases. ACAT I & II not formalized at all.
Scope of Acquisition	The CAM describes the acquisition of aircraft equipment for USAF by the USAF thresholds.	Describes the acquisition of aircraft's equipment for USAF by the USAF thresholds.	DN process is described for acquisition programs where NOTRE > 20% Production < 50%.	The scope of CAM is similar to that of DN ACAT III & IV.	DN process is described for acquisition programs where NOTRE > 20% Production < 50%.	The scope of CAM can be equated to major or less-than-major acquisition programs of the USAF (ACAT I & III).	CAM applies competition throughout the life cycle, the essentially fixed price procurement to single source.
Competition	Life-span competition exists at all times.	Life-span competition exists.	Competition used on a limited basis for development and solicitations for proposals. Essentially ceases to exist after production contract award.	Competition is used to limit equipment purchase cost.	Competition used on a limited basis for development and solicitations for proposals. Essentially ceases to exist after production contract award.	Competition is used to limit equipment purchase cost.	CAM applies competition throughout the life cycle, the essentially fixed price procurement to single source.
Procurement Cost	Airlines typically negotiate a final price that includes warranty and necessary initial support.	USAF initiates contract negotiations in include warranty and necessary initial support.	DN typically negotiates a final price that includes necessary logistics support for organic maintenance.	All methodologies negotiate to achieve lowest cost.	DN typically negotiates a final price that includes necessary logistics support for organic maintenance.	CAM does not require extensive R&D or T&E; uses state-of-the-art techniques. Testing is linked to proof of performance.	Suppliers to airlines typically include warranty in their cost quotations.
Research, Development, Test, and Evaluation	Certification required by TSO, little R&D sponsored by airlines.	USAF reducing planned & sponsored R&D. Some quality and acceptance tests still required.	Extensive R&D planned and sponsored by USAF. Rigorous quality and acceptance tests.	All processes perform some quality and acceptance tests.	All processes perform some quality and acceptance tests.	CAM does not require extensive R&D or T&E; uses state-of-the-art techniques. Testing is linked to proof of performance.	Suppliers to airlines typically include warranty in their cost quotations.
Procurement Package Selection Criteria	Consists primarily of logistic support contract items. AFMNC characteristic is not usually part of contract.	Consists of 1 specification, statement of work and other varied requirements as negotiated.	Typically consists of: (1) equipment specification (2) statement of work (3) data requirements Method is highly structured by DARS.	All procurement packages have various contract items, including requirement & imposed by procurement requirements, and schedule.	DN typically evaluates the technical, managerial, and cost aspects of the solicited proposals. Initial cost is usually the major selection factor.	CAM and USAF are concerned with the supplier performance, to specification prior to negotiation. CAM imposes strict formality and is not concerned with a management plan.	Procurement packages often containing DARS and program documents.
Procurement Source	The airlines are equally concerned with equipment and supplier performance. Satisfaction with past supplier performance is a major selection factor.	USAF typically evaluates the technical, managerial, and cost aspects of the solicited proposals. Cost and product performance are usually the major selection factors.	Manufacturers typically develop equipment only after contract award unless equipment has commercial application.	Manufacturers may develop equipment competing nominal inventories.	All processes involve varying amounts of manufacturer involvement.	Most equipment designed and developed at semi-in-house expense under CAM.	Some contractors most repair at depot and when extensive user of warranty repair. DN contractor most repair at organizational level.
Logistics Support/ Maintenance	Manufacturers typically develop equipment at own expense during or after specification development/ formulation.	Increasing use of warranty repair or contractor supported repair.	Three levels of maintenance for transnational, intermediate, and local. Repair is performed at all three levels bulk of repair for shipboard equipment performed at organizational level. Limited use of outside repair.	Essentially three levels of maintenance.	Three levels of maintenance for transnational, intermediate, and local. Repair is performed at all three levels bulk of repair for shipboard equipment performed at organizational level. Limited use of outside repair.	Most equipment designed and developed at semi-in-house expense under CAM.	Some contractors most repair at depot and when extensive user of warranty repair. DN contractor most repair at organizational level.

APPENDIX C
GLOSSARY OF ACRONYMS AND ABBREVIATIONS

ACAT	Acquisition Category
AEEC	Airlines Electronic Engineering Committee
AF	Air Force
AFLC	Air Force Logistic Command
AFSC	Air Force Systems Command
AFTEC	Air Force Test and Evaluation Center
AFR	Air Force Regulation
AHD	Avionics Historical Document
AM	Acquisition Manager
AMC	Avionics Maintenance Conference
AMP	Avionics Master Plan
APB	Avionics Planning Baseline
APBD	Avionics Planning Baseline Document
APP	Advance Procurement Plan
ARINC	Aeronautical Radio, Incorporated
ARC	Acquisition Review Council
ASU	Approval for Service Use
ATA	Air Transport Association of America
CAAM	Commercial Airline Acquisition Methodology
CAIG	Cost Analysis Improvement Group
CDS	Configuration Data Summary
CEB	CNO Executive Board
CNM	Chief of Naval Material
CNO	Chief of Naval Operations
COMOPTEVFOR	Commander, Operational Test and Evaluation Force
CSA	Combat System Architecture
CWI	Continuous Wave Illuminator
DA	Development Activity
DAC	Deputy for Avionics Control

DAE	Defense Acquisition Executive
DAR	Defense Acquisition Regulation
DCAA	Defense Contract Audit Agency
DCNO	Deputy, Chief of Naval Operations
DCP	Decision Coordinating Paper
DDR&E	Director of Defense Research and Engineering
DEPSECDEF	Deputy, Secretary of the Navy
DIA	Defense Intelligence Agency
DMSO	Director, Major Staff Office
DN	Department of the Navy
DNSARC	Department of the Navy Systems Acquisition Review Council
DOD	Department of Defense
DSARC	Defense System Acquisition Review Council
DT&E	Developmental Test and Evaluation
ECP	Engineering Change Proposal
EDM	Engineering Development Model
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FOT&E	Follow-On Operational Test and Evaluation
FY	Fiscal Year
FYDP	Five Year Defense Plan
F ³	Form, Fit, and Function
GFE	Government Furnished Equipment
ILS	Integrated Logistics Support
ILSM	Integrated Logistics Support Manager
ILSP	Integrated Logistics Support Plan
IOT&E	Initial Operational Test and Evaluation
JCS	Joint Chiefs of Staff
LCC	Life-Cycle Cost
LSCG	Logistic Support Cost Guarantee
MENS	Mission Element Needs Statement
MPS	Minimum Performance Standards
NATO	North Atlantic Treaty Organization
NAVPRO	Naval Plant Representative Office
NDCP	Navy Decision Coordinating Paper

NRL	Naval Research Laboratory
NSRDC	Naval Surface Research and Development Center
NSWC	Naval Surface Weapons Center
OJCS	Office of the Joint Chiefs of Staff
OPEVAL	Operational Evaluation
OSD	Office of the Secretary of Defense
OT&E	Operational Test and Evaluation
PAT&E	Production Acceptance Test and Evaluation
PCI	Product Configuration Identification
PM	Project Manager
PMP	Project Master Plan
POM	Program Objective Memoranda
PPBS	Planning, Programming, and Budgeting System
PTD	Provisioning Technical Document
R&D	Research and Development
RDT&E	Research, Development, Test, and Evaluation
RFP	Request for Proposals
RIW	Reliability Improvement Warranty
RTCA	Radio Technical Commission for Aeronautics
SARB	Service Approval Review Board
SDDM	Secretary of Defense Decision Memorandum
SECDEF	Secretary of Defense
SECNAV	Secretary of the Navy
SIMA	Shore Intermediate Maintenance Activity
SM	System Manager
SPO	System Program Office
SYSCOM	System Command
TECHEVAL	Technical Evaluation
TEMP	Test and Evaluation Master Plan
TSO	Technical Standard Order
T&E	Test and Evaluation
USAF	United States Air Force